UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2002/00251

February 6, 2003

Mr. Fred Patron
U.S. Department of Transportation
Federal Highway Administration
The Equitable Center, Suite 100
530 Center Street NE
Salem, OR 97301

Re: Endangered Species Act Section 7 Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation on the Federal Highway Administrations' Programmatic Consultation for Statewide Drilling, Surveying, and Hydraulic Engineering Activities in Oregon.

Dear Mr. Patron:

Enclosed is the biological opinion (Opinion) prepared by the National Marine Fisheries Service (NOAA Fisheries) under section 7 of the Endangered Species Act on geological drilling and surveying activities in Oregon. This Opinion addresses Snake River (SR) sockeye salmon (*Oncorhynchus nerka*), SR spring/summer-run chinook salmon (*O. tshawytscha*), SR fall chinook salmon, Lower Columbia River (LCR) steelhead (*O. mykiss*), SR steelhead, Upper Willamette River (UWR) steelhead, Middle Columbia River steelhead, Upper Columbia River (UCR) steelhead, Columbia River chum salmon (*O. keta*), LCR chinook salmon, UWR chinook salmon, UCR spring-run chinook salmon, Southern Oregon/Northern California coho salmon (*O. kisutch*), and Oregon Coast coho salmon.

NOAA Fisheries has determined that the proposed action is not likely to jeopardize the continued existence of the listed species described above or adversely modify their designated critical habitats. An Incidental Take Statement provides non-discretionary terms and conditions to minimize the potential for incidental take of listed species.

This document also serves as consultation on essential fish habitat for coho salmon, chinook salmon, groundfish and coastal pelagic fishes under the Magnuson-Stevens Fishery Conservation Management Act and its implementing regulations (50 CFR Part 600).

We appreciate the considerable effort and cooperation provided by your staff in completing this consultation. If you have any questions regarding this Opinion, please contact Tom Loynes 503.231.6892 of my staff in the Oregon Habitat Branch.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Molly Cary, ODOT
Greg Apke, ODOT
Nick Testa, ODOT
Mike Long, ODOT
Joe Squire, ODOT
Ken Franklin, ODOT
Randy Reeve, ODFW

Endangered Species Act Section 7 Consultation
Programmatic Biological Opinion

and

Magnuson-Stevens Fishery Management and Conservation Act
Essential Fish Habitat Consultation

Statewide Drilling, Surveying, and Hydraulic Engineering Activities

Agency: Federal Highway Administration

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Date Issued: February 6, 2003

Issued by: for Michael R Crouse

D. Robert Lohn
Regional Administrator

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1. INTRODUCTION

1.1 Background

On April 2, 2002, the National Marine Fisheries Service (NOAA Fisheries) received a request from the Federal Highway Administration (FHWA) for formal consultation pursuant to section 7 of the Endangered Species Act (ESA) for programmatic coverage for geological drilling and surveying activities in Oregon. The biological assessment (BA) provided with the request described FHWA's determination that some of the proposed activities would be "likely to adversely affect" anadromous fish species listed under the ESA and that others would be "not likely to adversely affect" listed fish. Species considered in this biological opinion (Opinion) are: Snake River (SR) sockeye salmon (*Oncorhynchus nerka*), SR spring/summer chinook salmon (*O. tshawytscha*), SR fall-run chinook salmon, Lower Columbia River (LCR) steelhead (*O. mykiss*), SR steelhead, Upper Willamette River (UWR) steelhead, Middle Columbia River (MCR) steelhead, Upper Columbia River (UCR) steelhead, Columbia River (CR) chum salmon (*O. keta*), LCR chinook salmon, UWR chinook salmon, UCR spring-run chinook salmon, Southern Oregon/Northern California (SONC) coho salmon (*O. kisutch*), and Oregon Coast (OC) coho salmon.

FHWA provides funding for geotechnical drilling and surveying activities occur across Oregon in preparation for new bridge construction. Nearly all streams with anadromous fish in the state of Oregon have species that are listed under the ESA. Many of these activities are minor in nature and consultation results in predictable requirements for approval of the project. The intent of the programmatic consultation is to develop standard local operating procedures and criteria to allow for efficient handling of geotechnical drilling and surveying projects while ensuring protection for listed species. This would expedite the permitting process for activities and alleviate the need for individual ESA consultation.

The objective of this Opinion is to determine whether the adoption of proposed standard conditions and operating procedures by FHWA for FHWA-funded geological drilling and surveying activities in Oregon is likely to jeopardize the continued existence of listed salmonids, or destroy or adversely modify the designated critical habitats of SR salmon and steelhead and SONC coho. This Opinion also documents consultation under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1996.[1]

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[1]Public Law 104-267, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act to establish new requirements for "Essential Fish Habitat" (EFH) descriptions in Federal fishery management plans (FMPs) and to require that Federal agencies consult with NOAA Fisheries on activities that may adversely affect EFH. Under section 305(b)(4) of the Act, NOAA Fisheries is required to provide discretionary EFH conservation and enhancement recommendations to Federal and state agencies for actions that may adversely affect EFH. However, state agencies and private parties are not required to consult with NOAA Fisheries unless that action requires a Federal permit or receive Federal funding.

1.2 Proposed Action

The proposed action involves the adoption of permit conditions for geological drilling and surveying activities in Oregon by FHWA that would preclude the need for further individual ESA consultation, and the application of standard local operating procedures by FHWA for these activities. The types of activities are: (1) Access road construction, (2) drill pad preparation, (3) access road and drill pad reclamation, (4) drilling and sampling operations, (5) mobilization and set up, (6) de-mobilization, (7) boring abandonment, (8) project development surveys, (9) construction surveys, and (10) boundary surveys.

1.2.1 Drilling, Surveying, Stormwater and Hydraulic Engineering Operations

1.2.1.1 Access Road Construction

In most cases, the construction of access roads for drill vehicles would not be necessary because of favorable topography at the site. Roads would be temporary and needed only for the duration of the drilling period. Occasionally, these roads would remain in place if more work, such as additional drilling or instrument installation, monitoring, or highway improvements is anticipated

Construction of the access roads would involve removing impassable objects and creating a flat surface. Access roads are typically 4.3 meters (m) wide. In some cases crushed rock is necessary to provide a stable driving surface. Geotextile material would be used to reduce the amount of crushed rock needed, as well as to make removal and reclamation easier once construction is finished. Truck-mounted drills may require more extensive access road work due to grade limitations and traction requirements for those types of vehicles. Track-mounted drills can generally cross steeper, more uneven and less stable ground with fewer disturbances. Additionally, water tankers and support vehicles may need to access the drill site depending on site conditions and the type of operation.

1.2.1.2 Drill Pad Preparation

Drill pads are the areas where the drill rig and support equipment are parked when the drill is operating. Usually, the pad is twice the size of the drill equipment in order to accommodate site safety requirements, and tool and supply storage. However, in many cases, the drill pads are reduced in size to minimize ground disturbance.

The drilling rig is stabilized using hydraulic leveling jacks, which require a level pad to work on for both types of drilling equipment. If a pad location had irregular or steep terrain, it would be graded to provide a level surface for placement of the drill equipment. The leveling is critical to drilling success and time spent.

1.2.1.3 Access Road and Drilling Pad Reclamation

All disturbed areas (*i.e.*, access roads, drill pads) would be re-graded to pre-project contours at project completion. Access roads and drill pads constructed as part of a proposed roadway project that will be constructed within 18 months of the drilling activity will be reseeded for erosion and sediment control. For projects where construction is not anticipated for more than 24 months, all disturbed habitat functions (not just erosion and sediment control) will be replaced, particularly where riparian vegetation has been removed during drilling activities. Monitoring and maintenance of restoration areas planted with woody vegetation will be conducted for a period of 5 years.

1.2.1.4 Drilling and Sampling Operations, Mobilization, and Setup

Drilling and sampling methods vary depending on the project. The method selected depends on the anticipated subsurface conditions at the site. Methods of drilling may vary from air rotary drilling where the boring is advanced using air-powered hammer and rotation, in which compressed air blows out of the bottom of the bit and blasts cuttings back to the surface, to water or mud rotary drilling where the rotating drill steel is advanced into the ground, applying downward pressure and washing the cuttings out of the boring with water or a drilling mud. Sampling techniques involve inserting and retrieving sampling instruments in the boring during the drilling process. Other exploration methods might include digging test pits with tire or track-mounted backhoes, or shallow borings with hand tools (hand augers or probes). Drilling and sampling techniques are described in detail in Appendix A of the BA.

On the typical exploratory operation, the drill rig is driven onto the site and drill pad. Sometimes drill pads are necessary when there is uneven ground surface conditions. The mast is raised and the drill rig is leveled using hydraulic leveling jacks. Wooden blocks and/or metal plates are placed under the jacks to minimize the potential for jacks sinking into the soil. If there is no drilling pad, then the site is cleared around the sides and back of the drill to allow room to work. Typically, this requires cutting brush and removing obstacles for a few feet on each side of the drill rig, and in an area (approximately 9 m x 2.5 m) at the rear of the drill. This varies per site and per drilling method. This site preparation is necessary to assemble the drill steel needed to work on site and to provide a safe working area. If the site is muddy, setup may also require spreading straw around the rig to provide a slip-free working area.

If water is required for drilling, a water tanker is parked as close to the drill rig as possible. If necessary, small ditches are dug or soil berms are constructed to channel water from the drilling process away from the work site. Erosion or sediment control measures are employed as needed. A support vehicle is usually parked as near to the drill as possible to provide easy access to tools and supplies. If this is not possible, supplies are either hand carried or loaded on a small tracked ATV and shuttled into the drill site.

Most impacts associated with mobilization and setup occur during the construction and reclamation of the drill pad. If a drill pad is not constructed, impacts that may occur during drill set-up include vegetation removal for access, and sediment run-off from ditches excavated to keep the site dry.

Auger Drilling
Auger drilling involves attaching an auger, with a carbide-toothed bit attached at the bottom, to the rotary drive spindle of the drill. The drilling is accomplished by rotation and downward pressure applied to the auger by the drill. If more depth is required than can be accommodated with the lead flight of auger (normally 1.5 m maximum), additional flights of auger (normally 1.5 m length) are attached, and the drilling is advanced to the necessary depth.

Typically, soil recovered from the drilling is spread out over the site and stabilized by seeding and mulching. The material can be removed from the site by placing it in barrels, which are later removed from the drill site. If no instrumentation is installed in the drill borings, the borings are typically abandoned by filling them with bentonite chips, pellets, or cement-bentonite grout.

Typical equipment used in this type of drilling operation includes a truck or track mounted drill with either solid or hollow stem augers (with/without continuous sampler apparatus), support vehicle(s), and a shovel (this would be the minimum equipment needed for this drilling activity).

Water or Mud Rotary Drilling
This method of drilling consists of advancing drill steel into the ground by applying rotation and downward pressure to the drill steel and bits. Water or drilling mud (fluid) is pumped down the inside of the drill steel to the bottom of the boring where it exits the bit. The fluid lubricates the bit and forces drill cuttings up through the boring annulus (area between the drill steel and the edges of the drill boring) and toward the ground surface. From 0 to 18,900 (L) per day of drilling fluid can be generated during this type of drilling. However, frequently after drilling begins, the drill fluid return ceases as the fluid is lost through more permeable zones of subsurface materials. When drill fluid returns to the surface, there are three different methods for handling the fluid that are used in conjunction with the following erosion and sediment control best management practices (BMPs):

1. Allowing the drill fluid and cuttings to free flow out of the boring and across the ground surface through the existing vegetation or through a "dirt bag" prior to allowing the filtered liquid to flow freely through the existing vegetation.

The drilling fluid flows out of the boring and the water or mud is diverted away from the work site. This sediment laden water is allowed to sheet flow over the ground surface and through the existing vegetation infiltrating into the ground. This method is typically used where the threat to fish habitat is minimal, usually away from streams.

In more sensitive environments where sediment retention is more critical, a "dirt bag" can be used. With this process, the returned drilling fluid is contained and forced to flow through the sediment filter that removes the larger particles of the sediment from the fluid and allows the filtered fluids to flow through the existing vegetation. The filter and collected sediment are then removed from the site.

2. Routing the drill fluid return to a sediment retention structure.

The drill fluid can be directed to a temporary sediment pond or containment system where the sediment-laden water is contained. The sediment settles to the base of the containment system and the water infiltrates into the ground. The water remaining in the pond may be reused in the drilling process. These ponds are generally constructed in areas that are already impacted or will create minimal new impacts.

When drilling is complete, the water in the containment system is allowed to infiltrate or it can be pumped to an acceptable location on site for disposal on the natural ground. Sediments remaining in the containment system can either be buried at the pond location or removed from the site. When buried on site, the disturbed material is stabilized by seeding and mulching. The drilling fluid is diverted to avoid environmentally sensitive areas (wetlands, vernal pools, streams).

3. Re-circulating the drilling fluid by filtering it and then reusing the fluid.

In this method, drilling fluids are captured, isolated and recirculated as they flow out of the boring. The drill cuttings settle within the tank and an adequate supply of water is maintained for drilling. When drilling is complete, the fluid is either disposed of at the site through existing upland vegetation, or is pumped to an approved location for disposal. Sediments collected are buried or mounded on site, and the area is seeded and mulched.

<u>In-water Drilling</u>
There are two primary situations where drilling is done in a wetted stream channel: (1) When an area that was expected to be dry is wet due to wetter-than-normal water years, or (2) when there is a need to drill within the margin of the wetted stream channel. In these cases, the drilling equipment is isolated from the water via a small platform or is sitting in the dry because a coffer dam has been constructed, isolating the work area from the stream. A sleeve or casing is then placed where the drilling would occur. This casing enables collection of drilling fluids similar to methods 2 and 3, outlined above. The drilling fluids are disposed of periodically at an upland location. A small pulse of turbidity may result when the drill penetrates the top layer of the substrate. When the sleeves are removed after drilling, some residual fluids may escape. Upon completion, each boring is filled with bentonite. The drill crew and geology manager pay close attention to flow stage and weather conditions in order to maintain an environmentally safe work site. Borings generally take from 1 to 3 days to complete.

Drilling in many cases takes place from the deck of a highway bridge. A diamond-cutting device is used to cut through the concrete and rebar in the bridge deck. Containment measures are placed to capture any debris from the cutting of the bridge deck. A casing of sufficient size is extended from the deck to the bottom of the waterway. This casing is embedded into the substrate, providing a seal that isolates the drill steel and the fluids from the water. The drilling fluids are returned up through the casing to the bridge deck and captured in a collection tank. The drilling fluids are disposed of periodically at an upland location. In some cases, an additional casing is needed to adequately contain the drilling fluids. A small pulse of turbidity may result when the drill penetrates the top layer of the substrate. When the sleeves are removed after drilling, some residual fluids may escape. Upon completion, each boring is filled with bentonite. The drill crew and geology manager pay close attention to flow stage and weather conditions in order to maintain an environmentally safe work site. Borings generally take from 1 to 3 days to complete.

Environmental (Hazardous Material) Drilling

Environmental drilling is conducted using a variety of methods, primarily geoprobe drilling or auger drilling. Fluids are not typically used when drilling for hazardous materials samples. A geoprobe is used for hazardous material exploration and is mounted on the back of a standard pickup or similar vehicle. Sampling is conducted by driving a 2.5 centimeter steel probe into the ground. Samples are collected in hollow tubes and capped for later analysis. This activity uses no fluids. When auger drilling, the cuttings are placed on plastic sheeting and covered, or in labeled barrels. Soil samples are lab-tested and properly disposed of under Oregon Division of Environmental Quality (ODEQ) guidelines.

Decontamination is required during environmental drilling operations. Decontamination is achieved as follows:

1. Decontamination of split spoons between samples. The split spoon is submersed in a bucket of soapy water and scrubbed off between samples, then rinsed in deionized water. The soap breaks down petroleum products into inert organic compounds. If the contamination is petroleum-based and at low levels, the waste water is dumped on site. If the contamination is other than petroleum, the water is contained in a barrel on site, the barrel is labeled, and a sample is obtained for lab testing. If the lab determines that the sample is not contaminated, the water is discharged on site. If the sample is contaminated, the barrels are removed from the site and handled per DEQ and Environmental Protection Agency (EPA) specifications for the waste product. The typical amount of water produced through this activity is approximately 15 L per boring.

2. Decontamination of drilling steel and bits between borings. The drill steel and bits are generally decontaminated at the drill site, but occasionally they are hand-loaded onto a trailer on a sheet of plastic and hauled to the steam cleaner located nearby or at a maintenance station. The steel parts are loaded onto the steam cleaner rack for cleaning. The waste wash-water or water with alconox is contained in a holding tank attached to the steam cleaner. If the steel is too big to fit over the holding tank, it is washed in a portable tank consisting of plastic sheeting surrounded by straw bales to contain the water. The used wash water is usually stored on-site in labeled barrels for lab testing. In rare cases, it is stored in the tank and allowed to evaporate.

In situations where the water is likely contaminated, the barrels are stored in a secondary containment area to avoid spills (this is typically plastic sheeting which is bermed with straw bales on all edges to create a "tank"). The amount of water varies (76 to 380 L), depending on the amount of steel being cleaned and the amount of soil adhering to the steel. The water testing takes approximately 5 days. If the tests indicate the water is clean, it is typically discharged on site. If the water is contaminated, the barrels are lifted onto a trailer and hauled off site and disposed of as per DEQ regulations for the waste product. If the water is stored and allowed to evaporate, the residue is tested and hauled off-site for disposal.

Drill Boring Instrumentation

This activity consists of placing materials, instruments and/or equipment into a completed boring (air or water/mud rotary, auger, or geoprobe) for the purpose of measuring or monitoring various *insitu* parameters over an extended period. Placement of instruments is usually done immediately upon completion of the boring utilizing most of the same equipment that was used in the drilling process. Borings are often backfilled with grout once the instruments have been installed. Grout is either mixed with a grout pump that is trailer mounted which is towed to the site behind a support vehicle or in a tank or trough with a hand mixer.

Materials used during boring instrumentation include grout made from Portland cement and powdered bentonite. In some cases, all or part of a bore hole might be backfilled with clean silica sand or bentonite pellets, rather than grout.

Casing installed in instrumented borings ranges from 1.3 to 20 cm (plastic) inclinometer casing or smaller diameter schedule 40 PVC. Flush-mount monument covers made of steel or concrete are installed to protect against accidents or vandalism.

There are no additional impacts for this activity beyond those described above for drilling operations, except for the potential of contamination to the ground surface and nearby streams or wetlands from excess grout.

Air Rotary Drilling

Air rotary drilling equipment range in size from small skid or track mounted rigs to large air rotary rigs used for water well drilling. This method of drilling utilizes an air powered hammer and compressed air. The air is forced down the casing and through the bit, blasting the cuttings back to the surface. This method uses no drilling fluids; however, a foaming agent is often used to help float the cuttings out of the boring. Once the boring advances below the water table, water is blasted (usually as a mist) out of the boring along with cuttings.

Test Pits

Test pits are dug (using a trackhoe or rubber-tired backhoe) to determine subsurface conditions and provide detailed, large-scale geologic information. This data is gathered from examination of the excavation walls and material. These pits are typically less than 6 m deep and about the width of the bucket. The soil from the pit is side-cast adjacent to the boring and placed back into the boring at completion.

Soil Testing
Soil testing is conducted by lowering a split spoon sampler in the boring and hammering repeatedly with a 64 kg mechanical hammer until the split spoon penetrates 0.5 m into the soil at the bottom of the boring. The hollow sampler attains the desired sample. This test is generally performed numerous times at regular depth intervals within the test boring.

There are several types of testing and sampling discussed in the BA including: Vane Shear testing, pressure meter testing, Shelby (thin-wall) tube sampling, and cone penetrometer testing. Typical equipment used for soil testing includes: Drill rig, support truck, drilling steel and bits, and drill steel racks.

1.2.1.5 De-mobilization and Boring Abandonment

During de-mobilization, the drill rig tower is lowered, the leveling jacks are retracted, and all tools and supplies are loaded onto the drilling rigs and support vehicles. All waste is removed, sometimes including soil and water. The boring is abandoned and vehicles are removed from the site. Erosion control devices that are no longer needed are removed. Any absorbent materials used to contain leaks are removed from the site. Disposal of absorbent materials is discussed in section 5.0 of the BA.

Boring abandonment is conducted after completion of boring and the boring is no longer needed. Abandonment is required under Oregon Department of Water Resource (ODWR) regulations. This activity also consists of removing any temporary instrumentation, usually by drilling out whatever has been installed and filling the boring with grout, bentonite chips or pellets, or similar material. The boring must be backfilled in such a way as to prevent groundwater migration between aquifers, increase vertical mobility of groundwater compared to conditions prior to the boring, and prevent surface water from entering the boring.

Materials used for boring abandonment include cement grout, bentonite pellets or powder, concrete, and native material.

1.2.1.6 Project Development, Construction, and Boundary Surveys

Project Development Surveys
Surveying for project development is essential to provide designers information on all the features located within the project area. Components of these surveys are fully described in the BA, and include:

1. Roadside inventory, utilities surveys, project control establishing vertical & horizontal benchmarks, topographic surveys, drainage studies, stream profile analysis, photogrammetry, and cadastral surveys (described in the BA).

2. Size of culverts, direction of flow and position of any drainage features in the stream or waterbody. Stormwater and hydraulic field activities may also include: Investigating the condition of hydraulic structures and adjacent ground and vegetation either visually and/or by probing, sampling channel material, streamflow gaging, water sampling, turbidity monitoring, photographing features, and identification and temporary flagging of geomorphic features such as high-water marks.

3. Stream profile analysis provides information on the open water features of a stream such as channel width and depth, ordinary high water mark, and meander channel.

<u>Construction Surveys</u>
Surveying for construction control is necessary to provide contractors precise information on where and how a roadway is to be constructed. Stakes are placed along the proposed roadway routes that provide contractors specific details for the construction of the road. Components of construction control include: Relocating control points, establishing centerlines, placing slope stakes and temporary stakes for right-of-way (ROW) & easements, staking for water detention ponds/bioswales, staking for wetland/stream mitigation, stream relocation, erosion control boundaries, determining drainage patterns, and staking for structures including bridges, culverts, and grade hubs.

<u>Boundary Surveys</u>
Boundary surveys are conducted to establish or re-establish a boundary line on the ground or to obtain data for constructing a map or plat showing a boundary line. Boundary surveys are to determine property ownership along a specific route and establish ROW rights along the route.

1.2.2 Best Management Practices for Effects Associated With Drilling and Surveying Activities

The following BMPs will apply to all of the activities associated with drilling and surveying where applicable. These activities will be coordinated with the biologist before proceeding with in-water work; removal of riparian vegetation; or installation of access roads near riparian areas, streams, or wetlands. These BMPs are in addition to those listed in "Routine Road Maintenance" (Water Quality and Habitat Guide Best Management Practices) by ODOT, July 1999. The primary intent of these BMPs is to limit or reduce sediment and drilling fluid escape and prevent petroleum from entering aquatic resources and to reduce disturbance of suitable habitat.

<u>Access Roads</u>
1. No in-water work (inside of the ordinary high water mark) will occur outside of the in-water work window for individual streams without NOAA Fisheries and/or USFWS written approval. Any actions that require placement of temporary fill in streams or wetlands areas will require completion of a U.S. Army Corps of Engineers (USACE) Clean Water Act (404) permit. In-stream habitat and bank conditions will be restored in any disturbed aquatic system.

2. When stream crossings are encountered for access to sites, a fisheries biologist will be consulted prior to crossing and/or placement of temporary (<18 months) or permanent culverts in the stream channel, and will contact NOAA Fisheries to determine potential impacts to listed species and the course of action that should be taken.

3. Culvert installation will be conducted in accordance with guidance from the regulatory agencies. Culverts will be installed in such a manner as to not block fish passage in accordance with NOAA Fisheries guidance, *Guidelines for Salmonid Passage at Stream Crossings*.

4. The number and size of entry points or access roads into work areas will be reduced.

5. Temporary roads installed over wetland resources, native shrub species (*e.g.* willow), or other resilient natural areas will utilize geotextile material as a base to reduce impacts and reduce restoration requirements, unless the equipment can drive over natural ground without impacts. If used, geotextile and temporary road material will be entirely removed after use of the temporary access has ended.

6. Pad construction will employ the same BMPs developed for road construction, including using geotextile material and complete removal after the work is completed.

7. When no other means of excavation is feasible without excessive damage, a spider hoe will be used to excavate test pits. A spider hoe "walks" on four hydraulically controlled legs, two with wheels and two with claws. It can maneuver around trees and brush and ascend or descend steep slopes.

8. When performing sub-surface investigations by excavating test pits, spider hoes will be used to eliminate the need for access road construction.

9. When crossing a stream channel is absolutely necessary, the vehicle will be inspected for fluid leaks. Any leaks found during the inspection will be repaired. The vehicle will be steam-cleaned prior to entering the wetted channel. In addition, vehicles will be outfitted with absorbent media to prevent stream contamination. Portable devices will be employed to bridge the drilling rig from the water when crossing (*e.g.* boards, metal rails or grates)

10. When possible, a crane will be used to lower the drilling equipment and platform, and eliminate the need for access roads.

11. Crossing of wetted areas (wetlands, ditches, stream crossings *etc.*) will be avoided when feasible. When no practical access alternative (through or across wetted areas) exists, temporary portable crossing devices such as, culverts, boards, metal rails or grates, crane mats, bridges will be used. The purpose of the crossing device is to isolate the equipment from impacts to the wetted areas. If a temporary portable crossing device is deployed

(particularly culverts), these devices must comply with state and Federal guidelines including fish passage statutes.

Contaminant Control

1. Whenever possible, equipment will be fully fueled before site access. If the vehicle will be crossing a stream, then it will be refueled only to the extent needed to finish the required borings. When refueling of the drilling equipment is required at the drill pad, within 150 feet of the stream, absorbent pads will be employed to ensure that any spilled fuel is contained on the drill pad.

2. Drill rigs and equipment will have a daily maintenance and inspection schedule to detect and repair potential problems.

3. If a contaminant release occurs, the vehicle or equipment will be immediately shut down, and the cause of the release will be repaired. In addition, plastic sheeting, absorbent pads and booms will be kept with the drilling supplies and will be deployed to contain or absorb the leaking fluids.

4. When drilling near streams or water bodies, appropriate isolation will be constructed between the drill and waterbody to direct spills away from the waterbody.

5. Environmentally safe operating fluids (refer to the material safety data sheet) may be used when drilling within the wetted channel.

6. Drill crews will use BMPs to contain or control drill fluids that have the potential to enter a waterbody, river or wetland. This may entail the use of drill fluid recirculation, bio-bags, swale filtration, silt fencing, straw bails, or sediment ponds. Ditches and berms may also be used to direct and contain the fluids until they either evaporate or seep into the ground. Drill fluids will not be allowed to drain directly into aquatic resources.

7. The drill crew will maintain and keep a spill cleanup kit at the drill site at all times. Crews will be trained and properly equipped to identify and cleanup spills.

8. The drill crew personnel will make daily checks of the condition of storage containers on site.

9. Contaminant releases will be cleaned up immediately when they are discovered.

10. Contaminants will be disposed of in accordance with current Oregon Department of Environmental Quality (DEQ) regulations. The drill crew will clean up any contaminant releases involving 10 gallons or less. A contaminant cleanup contractor will clean up releases over 10 gallons. A hazardous materials unit will be notified of all spills regardless of size.

11. Collected contaminated materials will be stored securely until they can be appropriately removed from the site.

12. Water used for decontamination will be contained on-site and secured. ODEQ requires that the water be stored on site until it is tested. Currently, water is discharged on site if tested and found to be clean. If it is to be discharged on site, it will be allowed to slowly infiltrate into the ground, only at least 50 feet from water bodies. If the water is likely contaminated, the barrels will be stored in a secondary containment area (to reduce potential releases) until analytical testing is conducted. Should the collected water be positive for contaminants, it will be transported off site for disposal. The barrels will be located in a secondary containment area that is not likely to be disturbed by activities on the site.

13. Manufacturer's recommendations will be followed for disposal of drilling fluids, lubricants and other materials potentially toxic to the species listed in Table 1 of the BA.

14. To reduce the potential for contamination, only enough products to complete a specific job will be stored on-site.

15. Green (uncured) cement grout (within 24 hours of pouring) will not come in contact with any surface water.

16. Excess grout produced during instrumentation or boring abandonment will be handled in such a manner as to keep it from reaching critical habitat such as wetlands or bodies of water.

17. Tools used for cement grout work will not be washed in surface water bodies. In addition, water used to wash tools used in concrete work will not be disposed in surface water bodies.

18. Dyes used in drainage studies will be non-toxic vegetable dyes or similar.

19. The practice of using short pieces of plastic ribbon to determine flow patterns in drainage studies will not be used.

<u>Erosion Control</u>

1. Projects will follow the guidelines of ODOT's *Field Manual for Erosion and Sediment Control* (2000).

2. To reduce the potential for erosion, the amount of vegetation removal for safe operations and installation of erosion control will be minimized. The trimming of woody vegetation will not include the removal of root material whenever possible.

3. Ditching will be conducted in as small an area as possible to reduce vegetation and soil disturbance.

4. Erosion control devices will be utilized (*e.g.* straw bales, silt fences) when ground disturbances occur near aquatic resources. Erosion control devices will be sufficient to ensure negligible increases in turbidity in adjacent and downstream systems.

5. Spoils produced by the drilling operation will be stored away from critical habitat areas (*e.g.* streams, wetlands, and waterways). During rainy periods, spoils will be covered to prevent washing into environmentally sensitive areas.

6. After drilling or surveying activities are completed, personnel will coordinate seeding and mulching of disturbed ground areas in accordance with ODOT's *Erosion Control Manual and Standard Environmental Specifications*.

<u>In-water Drilling</u>

1. When drilling is completed attempts will be made to remove the remaining drilling fluid from the sleeve (via pumping, *etc.*) to reduce the pulse of turbidity when removing the sleeve.

2. Work must be isolated from the wetted channel via sleeves, steel pile, sand bags, coffer dams or similar.

3. Construction debris related to drilling through the bridge deck will be contained and taken off site for disposal.

4. Drilling equipment will be isolated from contact with the water, and the platform will be contained in case of a contaminant release.

5. When deploying a sleeve or steel pile for isolation of drilling, measures (*e.g.* screening) will be placed over the end to eliminate the risk for fish entrapment within the sleeve.

<u>Compensatory Mitigation</u>

Compensatory mitigation for habitat impacts will be completed as part of the bridge construction project. Mitigation will occur within 24 months of completion of the construction project. If the bridge construction project is cancelled, mitigation will occur within 24 months of the drilling and surveying activity. Compensatory mitigation will be provided as follows:

1. Impacts to wetlands and streams will be mitigated in accordance with the guidelines of the regulatory agencies at the time of the impact. The biologists will coordinate mitigation of impacts addressed in the BA with regulatory agency personnel.

2. Tree removal along all intermittent or perennial streams containing the species listed in the BA will be limited to those trees less than eight cm dbh within 50 feet horizontal distance of the ordinary high water mark.

3. Tree removal will be mitigated on-site at a 2:1 replanting ratio.

4. Portions of new temporary access roads that are outside the footprint of the proposed bridge must be restored immediately following drilling activities.

General Conditions
In addition to specific conditions for activities, FHWA also proposes to apply ODOT's Standard Environmental Specifications, which are described in the BA.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

2.1.1 Biological Information and Critical Habitat

Actions permitted using this Opinion would occur within designated critical habitat for 4 of the 14 listed ESUs considered: SR sockeye salmon, SR spring/summer chinook salmon, SR fall chinook salmon, and SONC coho salmon.

Essential elements of critical habitat for listed salmonids are: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food (juvenile only), riparian vegetation, space, and safe passage conditions (50 CFR 226). Actions permitted using this Opinion may affect each of these essential elements, although the combination of essential elements affected would vary by specific action.

Biological information for the 14 listed ESUs covered in this Opinion is given below. Information for the Columbia basin ESUs is adapted from Appendix A McClure *et al.* (2000a). Further details regarding the life histories, factors for decline, and current range wide status of these species are in Table 1 and in NOAA Fisheries (2000).

Southern Oregon/Northern California Coho Salmon
In the 1940s, estimated abundance of SONC coho salmon ranged from 150,000 to 400,000 naturally spawning fish. Today, coho populations in this ESU are depressed, and number approximately 10,000 naturally-produced adults. Although the Oregon portion of the SONC coho ESU has declined drastically, the Rogue River basin increased substantially from 1974-1997. The bulk of current coho salmon production in this ESU consists of stocks from the Rogue River, Klamath River, Trinity River, and Eel River in Oregon. In Oregon south of Cape Blanco, all but one coho salmon stock is considered to be at high risk of extinction. South of Cape Blanco, all Oregon coho salmon stocks are depressed.

In contrast to the life history patterns of other anadromous salmonids, coho salmon have a relatively simple 3-year life cycle. Most SONC coho salmon enter rivers between September and February and spawn from November to January (occasionally into early spring). In-migration is influenced by river flow, especially for many small California stream systems that have sandbars at their mouths for much of the year except winter. Although coho salmon have been captured several thousand kilometers away from their natal stream, this species usually remains closer to its river of origin than chinook salmon. Coho typically spend two growing seasons in the ocean before returning to spawn as 3 year-olds, precocious males ("jacks") may return after only 6 months at sea.

Oregon Coast Coho Salmon

Within the OC coho salmon ESU, hatchery populations from the northern Oregon coast form a distinctive subgroup. Adult run and spawn-timing are similar to those along the Washington coast and in the Columbia River, but are less variable. While marine conditions off the Oregon and Washington coasts are similar, the Columbia River has greater influence north of its mouth, and the continental shelf becomes broader off the Washington coast. Upwelling off the Oregon coast is more variable and generally weaker than areas south of Cape Blanco.

Table 1. References for additional background on listing status/critical habitat/protective regulations/and biological information for the listed species addressed in this Opinion.

Species	Listing Status	Critical habitat	Protective Regulations	Biological Information/ Population Trends
Southern Oregon/ Northern California coho salmon	Threatened 02/18/97 62 FR 33038	05/05/99 64 FR 24049	07/18/1997 62 FR 38479	Weitkamp *et al.* 1995; NOAA Fisheries 1997a; Sandercock 1991; Nickelson *et al.* 1992; Jacobs *et al.* 2001
Oregon Coast coho salmon	Threatened 08/10/98 63 FR 42587		07/10/00 65 FR 42423	Weitkamp *et al.* 1995; Nickelson *et al.* 1992; NOAA Fisheries 1997b; Sandercock 1991
Snake River (SR) fall-run chinook salmon	Threatened 04/22/92 57 FR 14653	12/28/93 58 FR 68543	07/22/1992 57 FR 14653	Waples *et al.* 1991c; Healey 1991; ODFW and WDFW 1998
SR spring/summer-run chinook salmon	Threatened 04/22/92 57 FR 14653	12/28/93 58 FR 68543 and 10/25/19 64 FR 57399	04/22/1992 57 FR 14653	Matthews and Waples 1991; Healey 1991; ODFW and WDFW 1998
Lower Columbia River (LCR) chinook salmon	Threatened 03/24/99 64 FR 14308		07/10/00 65 FR 42423	Myers *et al.*1998; Healey 1991; ODFW and WDFW 1998
Upper Willamette River (UWR) chinook salmon	Threatened 03/24/99 64 FR 14308		07/10/00 65 FR 42423	Myers *et al.*1998; Healey 1991; ODFW and WDFW 1998
Upper Columbia River (UCR) spring-run chinook salmon	Endangered 03/24/99 64 FR 14308		ESA prohibition on take applies	Myers *et al.*1998; Healey 1991; ODFW and WDFW 1998
Columbia River chum salmon	Threatened 03/25/99 64 FR 14508		07/10/00 65 FR 42423	Johnson *et al.*1997; Salo 1991; ODFW and WDFW 1998
SR sockeye salmon	11/20/91 56 FR 58619 Endangered	12/28/93 58 FR 68543	ESA prohibition on take applies	Waples *et al.* 1991b; Burgner 1991; ODFW and WDFW 1998
UCR steelhead	08/18/97 62 FR 43937 Endangered		ESA prohibition on take applies	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
SR Basin steelhead	08/18/97 62 FR 43937 Threatened		07/10/00 65 FR 42423	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
LCR steelhead	03/19/98 63 FR 13347 Threatened		07/10/00 65 FR 42423	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
UWR steelhead	03/25/99 64 FR 14517 Threatened		07/10/00 65 FR 42423	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
Middle Columbia River steelhead	03/25/99 64 FR 14517 Threatened		07/10/00 65 FR 42422	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998

Estimated escapement of coho salmon in coastal Oregon was about 1.4 million fish in the early 1900s, with harvest of nearly 400,000 fish (Weitkamp *et al.* 1995). Abundance of wild OC coho salmon declined during the period from about 1965 to 1975, and has fluctuated at a low level since that time (Nickelson *et al.* 1992). Lichatowich (1989) concluded that current production potential (based on stock-recruit models) for OC coho salmon in coastal Oregon rivers was only about 800,000 fish, and he associated this decline with a reduction of nearly 50% in habitat capacity. Current abundance of coho on the Oregon coast may be less than 5% of that in the early part of this century. Recent spawner abundance in this ESU has ranged from about 20,000 adults in 1990, to near 80,000 adults in 1996, and an estimated 47,400 adult coho in 1999 (Jacobs *et al.* 2001). For more information on OC coho salmon life history and factors contributing to the decline of the ESU, see SONC coho salmon, above.

The OC coho salmon ESU is disproportionately distributed throughout its range. OC coho salmon escapements within the northern and mid-coast basins have averaged 39.8% over the 1990-1999 period of record. While OC coho salmon escapements within the southern basins have averaged 60.2% over the 1990-1999 period of record (Jacobs *et al.* 2001), reasons for this high productivity are probably related to additional rearing opportunities associated with the lake environments in the southern basins, and the relative size of the watersheds within these respective basins (Jacobs *et al.* 2001).

Snake River Fall-run Chinook Salmon

The Snake River basin drains an area of approximately 280,000 km^2 and incorporates a range of vegetative life zones, climatic regions, and geological formations. The SR ESU includes the mainstem river and all tributaries, from their confluence with the Columbia River to the Hells Canyon Dam complex. Because genetic analyses indicate that fall-run chinook salmon in the Snake River are distinct from the spring/summer-run in the Snake River basin (Waples *et al.* 1991), SR fall-run chinook salmon are considered separately from the other two forms. They are also considered separately from those assigned to the UCR summer- and fall-run ESU because of considerable differences in habitat characteristics and adult ocean distribution, and less definitive, but still significant, genetic differences. There is, however, some concern that recent introgression from Columbia River hatchery strays is causing the Snake River population to lose the qualities that made it distinct for ESA purposes.

SR fall-run chinook salmon remained stable at high levels of abundance through the first part of the twentieth century, but then declined substantially. Although the historical abundance of fall-run chinook salmon in the Snake River is difficult to estimate, adult returns appear to have declined by three orders of magnitude since the 1940s, and perhaps by another order of magnitude from pristine levels. Irving and Bjornn (1981) estimated that the mean number of fall-run chinook salmon returning to the Snake River declined from 72,000 during the period 1938 to 1949, to 29,000 during the 1950s. Further declines occurred upon completion of the Hells Canyon Dam complex, which blocked access to primary production areas in the late 1950s.

Fall-run chinook salmon in this ESU are ocean-type. Adults return to the Snake River at ages 2 through 5, with age 4 most common at spawning (Chapman *et al.* 1991). Spawning, which takes place in late fall, occurs in the mainstem and in the lower parts of major tributaries (NWPPC 1989; Bugert *et al.* 1990). Juvenile fall-run chinook salmon move seaward slowly as subyearlings, typically within several weeks of emergence (Chapman *et al.* 1991). Based on modeling by the Chinook Technical Committee, the Pacific Salmon Commission estimates that a significant proportion of the SR fall-run chinook (about 36%) are taken in Alaska and Canada, indicating a far-ranging ocean distribution. In recent years, only 19% were caught off Washington, Oregon, and California, with the balance (45%) taken in the Columbia River (Simmons 2000).

With hydrosystem development, the most productive areas of the Snake River basin are now inaccessible or inundated. The upper reaches of the mainstem Snake River were the primary areas used by fall-run chinook salmon, with only limited spawning activity reported downstream from river kilometer (Rkm) 439. The construction of Brownlee Dam (1958; Rkm 459), Oxbow Dam (1961; Rkm 439), and Hells Canyon Dam (1967; Rkm 397) eliminated the primary production areas of SR fall-run chinook salmon. There are now 12 dams on the mainstem Snake River, and they have substantially reduced the distribution and abundance of fall-run chinook salmon (Irving and Bjornn 1981).

The Snake River has contained hatchery-reared fall-run chinook salmon since 1981 (Busack 1991). The hatchery contribution to Snake River escapement has been estimated at greater than 47% (Myers *et al.* 1998). Artificial propagation is recent, so cumulative genetic changes associated with it may be limited. Wild fish are incorporated into the brood stock each year, which should reduce divergence from the wild population. Release of subyearling fish may also help minimize the differences in mortality patterns between hatchery and wild populations that can lead to genetic change (Waples 1999). See NOAA Fisheries 1999a for further discussion of the SR fall-run chinook salmon supplementation program.

Some SR fall-run chinook historically migrated over 1,500 km from the ocean. Although the Snake River population is now restricted to habitat in the lower river, genes associated with the lengthier migration may still reside in the population. Because longer freshwater migrations in chinook salmon tend to be associated with more-extensive oceanic migrations (Healey 1983), maintaining populations occupying habitat that is well inland may be important in continuing diversity in the marine ecosystem as well.

For the SR fall-run chinook salmon ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.86, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

Snake River Spring/Summer-run Chinook Salmon

SR spring-run and/or summer-run chinook salmon are found in several subbasins of the Snake River (CBFWA 1990). Of these, the Grande Ronde and Salmon Rivers are large, complex systems composed of several smaller tributaries that are further composed of many small streams. In contrast, the Tucannon and Imnaha Rivers are small systems with most salmon production in the main river. In addition to these major subbasins, three small streams (Asotin, Granite, and Sheep Creeks) that enter the Snake River between Lower Granite and Hells Canyon Dams provide small spawning and rearing areas (CBFWA 1990). Although there are some indications that multiple ESUs may exist within the Snake River basin, the available data do not clearly demonstrate their existence or define their boundaries.

Historically, SR spring and/or summer-run chinook salmon spawned in virtually all accessible and suitable habitat in the Snake River system (Evermann 1895, Fulton 1968). During the late 1800s, the Snake River produced a substantial fraction of all Columbia basin spring and summer chinook salmon, with total production probably exceeding 1.5 million in some years. By the mid-1900s, the abundance of adult spring and summer chinook salmon had greatly declined. Fulton (1968) estimated that an average of 125,000 adults per year entered the Snake River tributaries from 1950 through 1960. As evidenced by adult counts at dams, however, spring and summer chinook salmon have declined considerably since the 1960s.

In the Snake River, spring and summer chinook are both stream-type fish, with juveniles that migrate swiftly to sea as yearling smolts. Depending primarily on location within the basin (and not on run type), adults tend to return after either 2 or 3 years in the ocean. Both spawn and rear in small, high-elevation streams (Chapman *et al.* 1991), although where the two forms coexist, spring-run chinook spawn earlier and at higher elevations than summer-run chinook.

There is a long history of human efforts to enhance production of chinook salmon in the Snake River basin through supplementation and stock transfers. The evidence is mixed as to whether these efforts have altered the genetic makeup of indigenous populations. Straying rates appear to be low.

For the SR spring/summer-run chinook salmon ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period 1 ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

<u>Lower Columbia River Chinook Salmon</u>
The lower Columbia River is characterized by numerous short and medium-length rivers that drain the coast ranges and the west slope of the Cascade Mountains. The LCR chinook salmon ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (inundated by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run chinook salmon found in the Klickitat River, or the introduced Carson spring-run chinook salmon strain, are not included in this ESU. Spring-run chinook salmon in the Sandy River have been influenced by spring-run chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers *et al.* 1998). Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998a). "Tule" (LCR fall chinook) from the LCR chinook ESU were observed spawning in the Ives Island area during October 1999.

The Hardy/Hamilton Creeks/Ives Island complex is located along the Washington shoreline, approximately 2 miles below Bonneville Dam.

Historical records of chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

Most fall-run fish in the LCR chinook salmon ESU emigrate to the marine environment as subyearlings (Reimers and Loeffel 1967, Howell *et al.* 1985, WDF *et al.* 1993). Returning adults that emigrated as yearling smolts may have originated from the extensive hatchery programs in the ESU. It is also possible that modifications in the river environment have altered the duration of freshwater residence. Coded-wire tag (CWT) recoveries of LCR chinook salmon ESU fish suggest a northerly migration route, but, based on CWT recoveries, the fish contribute more to fisheries off British Columbia and Washington than to the Alaskan fishery. Tule fall chinook salmon return at adult ages 3 and 4, and "bright" fall chinook return at ages 4 and 5, with significant numbers returning at age 6. Tule and bright chinook salmon are distinct in their spawn timing.

The LCR chinook salmon ESU has been subject to intensive hatchery influence. Hatchery programs to enhance chinook salmon fisheries in the lower Columbia River began in the 1870s, releasing billions of fish over time. That equals the total hatchery releases for all other chinook ESUs combined (Myers *et al.* 1998). Although most of the stocks have come from inside the ESU, more than 200 million fish from outside the ESU have been released since 1930 (Myers *et al.* 1998).

For the LCR chinook salmon ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

Upper Willamette River Chinook Salmon

The UWR chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. In the past, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Albiqua Creek. Although the total number of fish returning to the Willamette has been relatively high (24,000), about 4,000 fish now spawn naturally in the ESU, two-thirds of which originate in hatcheries. The McKenzie River supports the only remaining naturally-reproducing population in the ESU (ODFW 1998a).

There are no direct estimates of the size of the chinook salmon runs in the Willamette basin before the 1940s. The Native American fishery at the Willamette Falls may have yielded 908,000 kilograms of salmon (454,000 fish, each weighing 9.08 kg) (McKernan and Mattson

1950). Based on egg collections at salmon hatcheries, the spring chinook salmon run in the 1920s may have been five times the run size of 55,000 fish in 1947, or 275,000 fish (Mattson 1948). Much of the early information on salmon runs in the upper Willamette River basin comes from operation reports of state and Federal hatcheries.

Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. The life history of chinook salmon in the UWR ESU includes traits from both ocean- and stream-type development strategies. CWT recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More Willamette fish are, however, recovered in Alaskan waters than fish from the LCR ESU. UWR chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs, however, recently, most fish have matured at age 4. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the upper Willamette basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

Hatchery production in the basin began in the late nineteenth century. Eggs were transported throughout the basin, resulting in current populations that are relatively homogeneous genetically (although still distinct from those of surrounding ESUs). Hatchery production continues in the Willamette River, with an average of 8.4 million smolts and fingerlings released each year into the main river or its tributaries between 1975 and 1994. Hatcheries are currently responsible for most production (90% of escapement) in the basin. The Clackamas River currently accounts for about 20% of the production potential in the Willamette basin, originating from one hatchery, combined with natural production areas that are primarily located above the North Fork Dam. The interim escapement goal of the state of Oregon for the area above North Fork Dam is 2,900 fish (ODFW 1998b). However, the system is so heavily influenced by hatchery production that it is difficult to distinguish spawners of natural stock from hatchery origin fish. Approximately 1,000 to 1,500 adults have been counted at the North Fork Dam in recent years.

Harvest on this ESU is high, both in the ocean and in-river. The total in-river harvest below the falls from 1991 through 1995 averaged 33%, and was much higher before then. Ocean harvest was estimated as 16% for 1982 through 1989. Total (marine and freshwater) harvest rates on UWR spring-run stocks were reduced considerably for the 1991 through 1993 brood years, to an average of 21% (ODFW 1998a).

For the UWR chinook salmon ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 1.01 to 0.63, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

<u>Upper Columbia River Spring-run Chinook Salmon</u>
The UCR ESU includes spring-run chinook populations found in Columbia River tributaries between Rock Island and Chief Joseph Dams, notably the Wenatchee, Entiat, and Methow River

basins. The populations are genetically and ecologically separate from the summer- and fall-run populations in the lower parts of many of the same river systems (Myers *et al.* 1998). Although fish in this ESU are genetically similar to spring chinook in adjacent ESUs (*i.e.*, MCR and SR), they are distinguished by ecological differences in spawning and rearing habitat preferences. For example, spring-run chinook in upper Columbia River tributaries spawn at lower elevations (500 to 1,000 m) than in the Snake and John Day River systems.

The upper Columbia River populations were intermixed during the Grand Coulee Fish Maintenance Project (1939 through 1943), resulting in loss of genetic diversity between populations in the ESU. Homogenization remains an important feature of the ESU. Fish abundance has trended downward both recently and over the long term. At least six former populations from this ESU are now extinct, and nearly all extant populations have fewer than 100 wild spawners.

UCR spring-run chinook are considered stream-type fish, with smolts migrating as yearlings. Most stream-type fish mature at 4 years of age. Few CWTs are recovered in ocean fisheries, suggesting that the fish move quickly out of the north central Pacific and do not migrate along the coast.

Spring-run chinook salmon from the Carson National Fish Hatchery (a large, composite, non-native stock) were introduced into, and have been released from, local hatcheries (Leavenworth, Entiat, and Winthrop National Fish Hatcheries [NFH]). Little evidence suggests that these hatchery fish stray into wild areas or hybridize with naturally-spawning populations. In addition to these national production hatcheries, two supplementation hatcheries are operated by the Washington Department of Fish and Wildlife (WDFW) in this ESU. The Methow Fish Hatchery Complex (operations began in 1992) and the Rock Island Fish Hatchery Complex (operations began in 1989) were both designed to implement supplementation programs for naturally-spawning populations on the Methow and Wenatchee Rivers, respectively (Chapman *et al.* 1995).

For the UCR spring-run chinook salmon ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.85 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b). NOAA Fisheries used population risk assessments for UCR spring-run chinook salmon and steelhead ESUs from the draft quantitative analysis report (QAR) (Cooney 2000). Risk assessments described in that report were based on Monte Carlo simulations, with simple spawner/spawner models that incorporate estimated smolt carrying capacity. Population dynamics were simulated for three separate spawning populations in the UCR spring-run chinook salmon ESU: Wenatchee, Entiat, and Methow populations. The QAR assessments showed extinction risks for UCR spring chinook salmon of 50% for the Methow, 98% for the Wenatchee, and 99% for the Entiat spawning populations. These estimates are based on the assumption that the median return rate for the 1980 brood year to the 1994 brood year series will continue into the future.

Columbia River Chum Salmon

Chum salmon of the CR ESU spawn in tributaries and in mainstem areas below Bonneville Dam. Most fish spawn on the Washington side of the Columbia River (Johnson *et al.* 1997). Previously, chum salmon were reported in almost every river in the lower Columbia River basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). Currently, WDFW regularly monitors only a few natural populations in the basin, one in Grays River, two in small streams near Bonneville Dam, and the mainstem area next to one of the latter two streams. Recently, spawning has occurred in the mainstem Columbia River at two spots near Vancouver, Washington, and in Duncan Creek below Bonneville Dam.

Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks, and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington. Genetic variability within and between populations in several geographic areas is similar, and populations in Washington show levels of genetic subdivision typical of those seen between summer- and fall-run populations in other areas, and are typical of populations within run types (Salo 1991, WDF *et al.* 1993, Phelps *et al.* 1994, Johnson *et al.* 1997).

Historically, the CR chum salmon ESU supported a large commercial fishery, landing more than 500,000 fish per year. Commercial catches declined beginning in the mid-1950s. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and chinook salmon, and some tributaries have a minor recreational harvest (WDF *et al.* 1993).

Hatchery fish have had little influence on the wild component of the CR chum salmon ESU. NOAA Fisheries estimates an median population growth rate (lambda) over the base period, for the ESU as a whole, of 1.04 (Tables B-2a and B-2b in McClure *et al.* 2000b). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NOAA Fisheries is unable to estimate the risk of absolute extinction for this ESU.

Snake River Sockeye Salmon

The only remaining anadromous sockeye in the Snake River system are found in Redfish Lake, on the Salmon River. The nonanadromous form (kokanee), found in Redfish Lake and elsewhere in the Snake River basin, is included in the ESU. SR sockeye were historically abundant in several lake systems of Idaho and Oregon. However, all populations have been extirpated in the past century, except fish returning to Redfish Lake.

In general, juvenile sockeye salmon rear in the lake environment for 1, 2, or 3 years before migrating to sea. Adults typically return to the natal lake system to spawn after spending 1, 2, 3, or 4 years in the ocean (Gustafson *et al.* 1997).

In 1910, impassable Sunbeam Dam was constructed 20 miles downstream of Redfish Lake. Although several fish ladders and a diversion tunnel were installed during subsequent decades, it is unclear whether enough fish passed above the dam to sustain the run. The dam was partly removed in 1934, after which Redfish Lake runs partially rebounded. Evidence is mixed as to whether the restored runs constitute anadromous forms that managed to persist during the dam years, nonanadromous forms that became migratory, or fish that strayed in from outside the ESU.

NOAA Fisheries proposed an interim recovery level of 2,000 adult SR sockeye salmon in Redfish Lake and two other lakes in the Snake River basin (Table 1.3-1 in NOAA Fisheries 1995). Low numbers of adult SR sockeye salmon preclude a QAR-type quantitative analysis of the status of this ESU. Because only 16 wild and 264 hatchery-produced adult sockeye returned to the Stanley River basin between 1990 and 2000, however, NOAA Fisheries considers the risk of extinction of this ESU to be very high.

Upper Columbia River Steelhead

The UCR steelhead ESU occupies the Columbia River basin upstream of the Yakima River. Rivers in the area primarily drain the east slope of the northern Cascade Mountains, and include the Wenatchee, Entiat, Methow, and Okanogan River basins. The climate of the area reaches temperature and precipitation extremes; most precipitation falls as mountain snow (Mullan *et al.* 1992b). The river valleys are deeply dissected and maintain low gradients, except for the extreme headwaters (Franklin and Dyrness 1973).

Estimates of historical (pre-1960s) abundance specific to this ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a prefishery run size exceeding 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.* 1994). Runs may, however, already have been depressed by lower Columbia River fisheries.

As in other inland ESUs (the Snake River and mid-Columbia basins), steelhead in the UCR ESU remain in freshwater up to a year before spawning. Smolt age is dominated by 2-year-olds. Based on limited data, steelhead from the Wenatchee and Entiat rivers return to freshwater after 1 year in salt water, whereas Methow River steelhead are primarily age-2-ocean (Howell *et al.* 1985). Life history characteristics for UCR steelhead are similar to those of other inland steelhead ESUs, however, some of the oldest smolt ages for steelhead, up to 7 years, are reported from this ESU. The relationship between anadromous and nonanadromous forms in the geographic area is unclear.

Hatchery fish are widespread and escape to spawn naturally throughout the region. Spawning escapement is dominated by hatchery-produced fish.

For the UCR steelhead ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b). Because of data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups: Wenatchee/Entiat composite, and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100%. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35% for the Wenatchee/Entiat, and 28% for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100% were projected for both populations.

Snake River Basin Steelhead

Steelhead spawning habitat in the Snake River is distinctive in having large areas of open, low-relief streams at high elevations. In many Snake River tributaries, spawning occurs at a higher elevation (up to 2,000 m) than for steelhead in any other geographic region. SR basin steelhead also migrate farther from the ocean (up to 1,500 km) than most.

No estimates of historical (pre-1960s) abundance specific to this ESU are available.

Fish in this ESU are summer-run steelhead. They enter freshwater from June to October and spawn during the following March to May. Two groups are identified, based on migration timing, ocean-age, and adult size. A-run steelhead, thought to be predominately age-1-ocean, enter freshwater during June through August. B-run steelhead, thought to be age-2-ocean, enter freshwater during August through October. B-run steelhead typically are three to four inches longer at the same age. Both groups usually smolt as 2- or 3-year-olds (Whitt 1954, Hassemer 1992). All steelhead are iteroparous (capable of spawning more than once before death).

Hatchery fish are widespread and stray to spawn naturally throughout the region. In the 1990s, an average of 86% of adult steelhead passing Lower Granite Dam were of hatchery origin. Hatchery contribution to naturally-spawning populations varies, however, across the region, hatchery fish dominate some stocks, but do not contribute to others.

For the SR basin steelhead ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

Lower Columbia River Steelhead

The LCR ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia River, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the Lower Columbia River ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the upper Willamette River basin and coastal runs north and south of the Columbia River mouth. Not included in the ESU are runs in the Willamette River above Willamette Falls (UWR ESU), runs in the Little and Big White Salmon rivers (MCR ESU), and runs based on four imported hatchery stocks: Early-spawning winter Chambers Creek/lower Columbia River mix, summer Skamania Hatchery stock, winter Eagle Creek NFH stock, and winter Clackamas River ODFW stock (63 FR 13351 and 13352). This area has at least 36 distinct runs (Busby *et al.* 1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU, for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs.

For the larger runs, current counts have been in the range of one to 2,000 fish (Cowlitz, Kalama, and Sandy Rivers), historical counts, however, put these runs at more than 20,000 fish. In general, all runs in the ESU have declined over the past 20 years, with sharp declines in the last 5 years.

Steelhead in this ESU likely use estuarine habitats extensively during out-migration, smoltification, and spawning migrations.

Many populations of steelhead in the LCR ESU are dominated by hatchery escapement. Roughly 500,000 hatchery-raised steelhead are released into drainages within this ESU each year. As a result, first-generation hatchery fish likely make up 50-80% of the fish counted on natural spawning grounds. The effect of hatchery fish is not uniform, however. Several runs are mostly hatchery strays: The winter run in the Cowlitz River (92%), the Kalama River (77%), and the summer run in the North Fork Washougal River (50%). Others, however, are almost free of hatchery influence: The summer run in the mainstem Washougal River (0%), and the winter runs in the North Fork Toutle and Wind Rivers (0-1%).

Escapement estimates for the steelhead fishery in the LCR ESU are based on in river and estuary sport-fishing reports; there is a limited ocean fishery on this ESU. Harvest rates range from 20-50% on the total run, but for hatchery-wild differentiated stocks, harvest rates on wild fish have dropped to 0-4% in recent years (punch card data from WDFW through 1994).

For the LCR steelhead ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

Upper Willamette River Steelhead

The UWR steelhead ESU occupies the Willamette River and tributaries upstream of Willamette Falls, extending to and including the Calapooia River. These major river basins containing spawning and rearing habitat comprise more than 12,000 km^2 in Oregon. Rivers that contain naturally-spawning winter-run steelhead include the Tualatin, Molalla, Santiam, Calapooia, Yamhill, Rickreall, Luckiamute, and Mary's, although the origin and distribution of steelhead in a number of these basins is being debated. Early migrating winter and summer steelhead have been introduced into the upper Willamette basin, but those components are not part of the ESU. Native winter steelhead within this ESU have been declining since 1971, and have exhibited large fluctuations in abundance.

In general, native steelhead of the upper Willamette basin are late-migrating winter steelhead, entering freshwater primarily in March and April. This atypical run timing appears to be an adaptation for ascending Willamette Falls, which functions as an isolating mechanism for UWR steelhead. Reproductive isolation resulting from the falls may explain the genetic distinction between steelhead from the upper Willamette basin and those in the lower river. UWR late-migrating steelhead are ocean-maturing fish. Most return at age 4, with a small proportion returning as 5-year-olds (Busby *et al.* 1996).

Willamette Falls (Rkm 77) is a known migration barrier. Winter steelhead and spring chinook salmon historically occurred above the falls, whereas summer steelhead, fall chinook, and coho salmon did not.

The main hatchery production of native (late-run) winter steelhead occurs in the North Fork Santiam River, where estimates of hatchery proportion in natural spawning areas range from 14-54% (Busby *et al.* 1996). More recent estimates of the percentage of naturally-spawning fish attributable to hatcheries in the late 1990s are 24% in the Molalla, 17% in the North Santiam, 5-12% in the South Santiam, and less than 5% in the Calapooia (Chilcote 1997).

For the UWR steelhead ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.87, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b).

Middle Columbia River Steelhead

The MCR steelhead ESU occupies the Columbia River basin from above the Wind River in Washington, and the Hood River in Oregon, and continues upstream to include the Yakima River, Washington. The region includes some of the driest areas of the Pacific Northwest, generally receiving less than 16 inches of precipitation annually (Jackson 1993). Summer steelhead are widespread throughout the ESU, with winter steelhead occurring in Mosier, Chenowith, Mill, and Fifteenmile Creeks in Oregon, and in the Klickitat and White Salmon Rivers in Washington. The John Day River probably represents the largest native, naturally-spawning stock of steelhead in the region.

Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, which has an estimated run size of 100,000 (WDF *et al.* 1993). Assuming comparable run sizes for other drainage areas in this ESU, the total historical run size may have exceeded 300,000 steelhead.

Most fish in this ESU smolt at 2 years and spend 1-2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell *et al.* 1985, BPA 1992). All steelhead upstream of The Dalles Dam are summer-run (Schreck *et al.* 1986, Reisenbichler *et al.* 1992, Chapman *et al.* 1994). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age-1- and 2-ocean fish. A nonanadromous form co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

Continued increases in the proportion of stray steelhead in the Deschutes River basin is a major concern. The ODFW and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) estimate that 60-80% of the naturally-spawning population consists of strays, which greatly outnumber naturally-produced fish. Although the reproductive success of stray fish has not been evaluated, their numbers are so high that major genetic and ecological effects on natural populations are possible (Busby *et al.* 1999). The negative effects of any interbreeding between stray and native steelhead will be exacerbated if the stray steelhead originated in geographically distant river basins, especially if the river basins are in different ESUs. The populations of steelhead in the Deschutes River basin include steelhead native to the Deschutes River, hatchery steelhead from the Round Butte Hatchery on the Deschutes River, wild steelhead strays from other rivers in the Columbia River basin, and hatchery steelhead strays from other Columbia River basin streams

Regarding the latter, CTWSRO has reported preliminary findings from a tagging study by T. Bjornn and M. Jepson (University of Idaho), and NOAA Fisheries suggests that a large fraction of the steelhead passing through Columbia River dams (*e.g.*, John Day and Lower Granite dams) have entered the Deschutes River and then returned to the mainstem Columbia River. A key unresolved question about the large number of strays in the Deschutes River basin is how many stray fish remain in the basin and spawn naturally.

For the MCR steelhead ESU, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period10 ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b)

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitats. This analysis involves the initial steps of defining the biological requirements of the listed species, and evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize, it must identify reasonable and prudent alternatives for the action.

NOAA Fisheries also evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitats. NOAA Fisheries must determine whether habitat modifications appreciably diminish the value of critical habitats for both survival and recovery of the listed species. NOAA Fisheries identifies those effects of the action that impair the function of any essential feature of critical habitat. NOAA Fisheries then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NOAA Fisheries concludes that the action will adversely modify critical habitat, it must identify any reasonable and prudent alternatives available.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NOAA Fisheries' critical habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for migration, spawning, and rearing of the listed species under the existing environmental baseline.

2.1.2.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess to the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection and also considers new data available that is relevant to the determination.

The relevant biological requirements are those necessary for salmonids to survive and recover to naturally-reproducing population levels at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance its capacity to adapt to various environmental conditions, and allow it to become self-sustaining in the natural environment.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful adult migration and holding, spawning, incubation, migration, over-wintering, juvenile out-migration, and smoltification. Salmon survival in the wild depends upon the proper functioning of ecosystem processes, including habitat formation and maintenance. Restoring functional habitats depends largely on allowing natural processes to increase their ecological function, while at the same time removing adverse effects of current practices. In conducting analyses of habitat-altering actions, NOAA Fisheries usually defines the biological requirements in terms of a concept called properly functioning condition (PFC) and utilizes a "habitat approach" to conduct its analysis.[2] The current status of listed salmonids in the state of Oregon, based upon their risk of extinction, has not significantly improved since the species were listed. NOAA Fisheries is not aware of any new data that would indicate otherwise.

2.2.2.2 Environmental Baseline

Regulations implementing section 7 of the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, state, or private actions and other human activities in the action area. The environmental baseline also includes the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions that are contemporaneous with the consultation in progress.

The action area is defined by NOAA Fisheries regulations (50 CFR 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area is the State of Oregon, specifically any watersheds that may contain ESA-listed salmon or steelhead. The action area may also extend upstream or downstream of actual projects, based on the potential of the permitted activities to impair fish passage, riparian succession, the hydrologic cycle, the erosion, transportation and deposition of sediments, and other ecological processes related to the formation and maintenance of salmon habitats. Indirect effects may occur throughout the watershed where other activities depend on actions described in this Opinion for their justification or usefulness.

The analysis presented in this section is based primarily on the *Oregon State of the Environment Report 2000* (*Report*), published by the Oregon Progress Board in September 2000 (Risser 2000) and the Programmatic Biological Evaluation produced for this Opinion (USACE 2002). The *Report* provides a comprehensive review of Oregon's environmental baseline in terms of all of its interrelated parts and natural processes. It was developed using a combination of analyses of existing data and best professional scientific judgment. Aquatic ecosystems, marine ecosystems, estuarine ecosystems, freshwater wetlands, and riparian ecosystems were among the resources considered. A set of indicators of ecosystem health was proposed for each resource system and as benchmarks for the State's use in evaluating past decisions and for planning future policies to improve Oregon's environment and economy. The *Report* also included findings regarding the

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[2] National Marine Fisheries Service, Northwest Region. 26 August 1999. The Habitat Approach: Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids. Guidance memorandum from Assistant Regional Administrators for Habitat Conservation and Protected Resources to staff. 13 pages. NOAA Fisheries, 525 NE Oregon St, Ste 500, Portland, OR 97232-2737.

environmental health of Oregon's eight ecoregions and conclusions about future resource management needs. Highlights of the *Report* follow.

Oregon's currently available water supplies are fully or often over allocated during low flow months of summer and fall. In the Columbia Plateau ecoregion, less that 20% of instream water rights can expect to receive their full allocation nine months of the year. In the Willamette Valley and Cascades ecoregions, more than 80% of the instream water rights can expect to receive their full allocation in the winter, but only about 25% in the early fall. Increased demand for water is linked to the projected 34% increase in human population over the next 25 years in the state. Depletion and storage of natural flows have altered natural hydrological cycles in basins occupied by listed ESUs. This may cause juvenile salmon mortality through migration delay resulting from insufficient flows or habitat blockages, loss of sufficient habitat due to dewatering and blockage, stranding of fish resulting from rapid flow fluctuations, entrainment of juveniles into poorly screened or unscreened diversions, and increased juvenile mortality resulting from increased water temperatures (Spence *et al.* 1996). Reduced flows also negatively affected fish habitats due to increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and exotic vegetation into spawning and rearing areas. Further, some climate models predict 10-25% reductions in late spring-summer-early fall runoff amounts in the coming decades.

Water quality in Oregon was categorized using the Oregon Water Quality Index (OWQI). The OWQI is a large, consistent and reliable data set that covers the state. It is based on a combination of measurements of temperature, dissolved oxygen, biochemical oxygen demand, pH, ammonia and nitrate nitrogen, total phosphorus, total solids and fecal coliform. Because water quality is influenced by streamflow, water quality indices are measured during high and low flow periods. Two key water quality factors affecting salmon are water temperature and fine sediment. Summer temperatures above 16ºC put fish at greater risk of effects that range from the individual organism to the aquatic community level. These effects impair salmon productivity from the reach to the stream network scale by reducing the area of usable habitat and adversely affecting fish growth, behavior and disease resistance. The loss of vegetative shading is the predominant cause of elevated summer water temperatures. Smaller streams with naturally lower temperatures that are critical to maintaining downstream water temperatures are most vulnerable to this effect. The same factors that elevate summer water temperature can decrease winter water temperatures and put salmon at additional risk. Widespread channel widening and reduced base flows further exacerbate seasonal water temperature extremes.

Sedimentation from logging, mining, urban development, and agriculture is a primary cause of salmon habitat degradation. In general, effects of sedimentation on salmon are well documented and include: (1) Clogging and abrasion of gills and other respiratory surfaces; (2) adhering to the chorion of eggs; (3) providing conditions conducive to entry and persistence of disease-related organisms; (4) inducing behavioral modifications; (5) entombing early life stages; (6) altering water chemistry by the absorption of chemicals; (7) affecting useable habitat by scouring and filling pools and riffles and changing bedload composition; (8) reducing photosynthetic growth and primary production; and (9) reducing intergravel permeability and dissolved oxygen (Spence *et al.* 1996).

Generally, water quality in Oregon is poor for salmon during low flow periods, except in mountainous areas. Areas with excellent or good water quality occur most often in forested uplands. Poor or very poor water quality occurs most often in non-forested lowlands where land has been converted to agricultural and urban uses. Most ecoregions include some rivers and streams with excellent water quality and other with very poor water quality. Only the Cascades ecoregion has excellent water quality overall as shown by average OWQI measurements. The Willamette Valley, Columbia Plateau, Northern Basin and Range, and southern end of the Eastern Cascade Slope ecoregions have poor water quality indices. The effects of pesticides and fertilizers, especially nitrates, on water supplies and aquatic habitats are a significant concern. Almost all categories of water pollution are growing, as are hazardous waste emissions, air pollution, toxic releases, and waste generation.

Depending on the species, salmon spend from a few days to one or two years in an estuary before migrating out to the ocean. Natural variability and extremes in temperature, salinity, tides and river flow make estuarine ecosystems and organisms relatively resilient to disturbance. However, alterations such as filling, dredging, the introduction of nonnative species, and excessive waste disposal have changed Oregon's estuaries, reducing their natural resiliency and functional capacity. The most significant historical changes in Oregon's estuaries are the diking, draining and filling of wetlands and the stabilization, dredging and maintenance of navigation channels. Between 1870 and 1970, approximately 50,000 acres, or 68% of the original tidal wetland areas in Oregon estuaries, were lost. Despite these significant historical wetland conversions and continuing degradation by pollutants, nuisance species, and navigational improvement, much of the original habitat that existed in the mid-1800s is still relatively intact. Hundreds of acres of former estuarine marshes are now being restored.

Non-native species now comprise a significant portion of Oregon's estuarine flora and fauna. Some, such as the European green crab, pose serious threats to the native estuarine communities necessary to support healthy salmon populations. Consumptive use of fresh water in the upper watersheds has reduced freshwater inflow to estuaries by as much as 60-80%, thus reducing the natural dilution and flushing of pollutants.

Oregon contains approximately 114,500 miles of rivers and streams. No statewide measurements exist of the area of riparian vegetation, although some estimates have been made for more localized regions. Using the conservative estimate of a 100-yard riparian corridor on each side of the stream, the total area of riparian habitats for flowing water in Oregon may be 22,900 square miles. That is equal to approximately 15% of the total area of the state. With the exception of fall chinook, which generally spawn and rear in the mainstem, most salmon and steelhead spawning and rearing habitat is found in tributaries where riparian areas are a major habitat component. Healthy riparian areas retain the structure and function of natural landscapes as they were before the intensive land use and land conversion that has occurred over the last 150 to 200 years. However, land use activities have reduced the numbers of large trees, the amount of closed-canopy forests, and the proportion of older forests in riparian areas. In western Oregon, riparian plan communities have been altered along almost all streams and rivers.

In the western Cascades, Willamette Valley, Coast Range, and Klamath Mountains, riparian areas on privately-owned land are dominated by younger forests because of timber harvest, whereas riparian areas on public lands have more mature conifers. Old coniferous forests now comprise approximately 20% of the riparian forests in the Cascades, but only 3% in the Coast Range. Older forests historically occurred along most of the McKenzie River, but now account for less than 15% of its riparian forests. Along the mainstem of the upper Willamette River, channel complexity has been reduced by 80% and the total area of riparian forest has been reduced by more than 80% since the 1850s. Downstream portions of the Willamette River have experienced little channel change, but more than 80% of the historical riparian forest has been lost.

Beginning in the early 1800s, riparian areas in eastern and southern Oregon were extensively changed by trapping beaver, logging, mining, livestock grazing, agricultural activities, and associated water diversion projects. Very little of the once extensive riparian vegetation remains to maintain water quality and provide habitats for threatened salmon. Dams have affected flow, sediment, and gravel patterns, which in turn have diminished regeneration and natural succession of riparian vegetation along downstream rivers. Introduced plant species pose a risk to some riparian habitat by dominating local habitats and reducing the diversity of native species. Improper grazing in riparian areas is another significant threat.

Occurrence of tumors, lesions, and deformities in fish is a direct measure of fish health. Systematic data regarding this problem are not available statewide. In the Willamette River, skeletal deformities comprised less than 5% of the sampled population upstream from Corvallis, 20% between Corvallis and Newberg, and 56% of the sampled population in the Newberg pool.

More than 32 species of freshwater fish have been introduced into Oregon, and are now self-sustaining, making up approximately one-third of Oregon's freshwater fish fauna. Introduced species are frequently predators on native species, compete for food resources, and alter freshwater habitats. In 1998, introduced species were found to comprise 5% of the number of species found in the upper Willamette River, but accounted for 60% of the observed species in the lower river near Portland.

In summary, the *Report* makes it clear that environmental baseline conditions are most critical in lowlands of major river basins, where most Oregonians live and work. Flow conditions and water quality are poor and riparian structure and function has been significantly degraded from historical conditions. These and other problems reflect the aggregate effects of many small, diffuse, individual decisions and actions.

Even before mainstem dams were built, habitat was lost or severely damaged in small tributaries by construction and operation of irrigation dams and diversions, inundation of spawning areas by impoundments, and siltation and pollution from sewage, farming, logging, and mining (Fulton

1968). Recently, the construction of hydroelectric and water storage dams without adequate provision for adult and juvenile passage in the upper Snake River has kept fish from all spawning areas upstream of Hells Canyon Dam.

As in other ESUs, LCR chinook salmon have been affected by the alteration of freshwater habitat (Bottom *et al.* 1984, WDF *et al.* 1993, Kostow 1995). Timber harvesting and associated road building peaked in the 1930s, but effects from the timber industry remain (Kostow 1995). Agriculture is widespread in this ESU and has affected riparian vegetation and stream hydrology. The ESU is also highly affected by urbanization, including river diking and channelization, wetland draining and filling, and pollution (Kostow 1995).

The lower reaches of the Columbia River are highly modified by urbanization and dredging for navigation. The upland areas covered by this ESU are extensively logged, affecting water quality in the smaller streams used primarily by summer runs. In addition, all major tributaries used by LCR steelhead have some form of hydraulic barrier that impedes fish passage. Barriers range from impassible structures in the Sandy River basin that block access to extensive, historically occupied, steelhead habitat, to passable but disruptive projects on the Cowlitz and Lewis Rivers. The Biological Review Team (BRT 1997) viewed the overall effect of hydrosystem activities on this ESU as an important determinant of extinction risk.

Human activities have had vast effects on the salmonid populations in the Willamette River basin. First, the Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat (*i.e.*, stream shoreline) by as much as 75 %. In addition, the construction of 37 dams in the basin has blocked access to over 700 km of stream and river spawning habitat. The dams also alter the temperature regime of the Willamette and its tributaries, affecting the timing of development of naturally-spawned eggs and fry. Water quality is also affected by development and other economic activities. Agricultural and urban land uses on the valley floor, as well as timber harvesting in the Cascade and Coast ranges, contribute to increased erosion and sediment load in Willamette River basin streams and rivers. Finally, since at least the 1920s, the lower Willamette River has suffered municipal and industrial pollution.

Detroit and Big Cliff Dams cut off 540 km of spawning and rearing habitat in the North Santiam River. In general, habitat in this ESU has become substantially simplified since the 1800s by removal of large woody debris to increase the river's navigability.

Spawning and rearing habitat in the Columbia River and its tributaries upstream of the Yakima River include dry areas where conditions are less conducive to steelhead survival than in many other parts of the Columbia River basin (Mullan *et al.* 1992). Salmon in the UCR ESU must pass up to nine Federal and private dams, and Chief Joseph Dam prevents access to historical spawning grounds farther upstream. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects, and livestock grazing along riparian corridors. Overall harvest rates are low for this ESU, currently less than 10% (ODFW and WDFW 1995).

The Chief Joseph and Grand Coulee Dam construction caused blockages of substantial habitat, as did that of smaller dams on tributary rivers. Habitat issues for the UCR ESU relate mostly to irrigation diversions and hydroelectric dams, as well as to degraded riparian and instream habitat from urbanization and livestock grazing.

Hydrosystem projects create substantial habitat blockages in the SR ESU; the major ones are the Hells Canyon Dam complex (mainstem Snake River) and Dworshak Dam (North Fork Clearwater River). Minor blockages are common throughout the region. Steelhead spawning areas have been degraded by overgrazing, as well as by historical gold dredging and sedimentation due to poor land management. Habitat in the Snake River basin is warmer and drier and often more eroded than elsewhere in the Columbia River basin or in coastal areas.

The only substantial habitat blockage now present in the MCR ESU is at Pelton Dam on the Deschutes River, but minor blockages occur throughout the region. Water withdrawals and overgrazing have seriously reduced summer flows in the principal summer steelhead spawning and rearing tributaries of the Deschutes River. This is significant because high summer and low winter temperatures are limiting factors for salmonids in many streams in this region (Bottom *et al.* 1984).

Factors contributing to the decline of SONC coho include overutilization for commercial recreational, scientific, or education purposes. Harvest management practiced by Native American tribes is conservative, and has resulted in limited impact on the coho stock in the Klamath and Trinity Rivers. Over-fishing in non-tribal fisheries is believed to have been a significant factor in the decline of coho salmon. Marked hatchery coho may be harvested in the Rogue River. All other recreational coho salmon fisheries in the Oregon portion of this ESU are closed. Collection for scientific research and educational programs has had little or no impact on coho populations in the ESU. Relative to other effects, disease and predation are not major factors contributing to the overall decline of coho salmon in this ESU. However, disease and predation may have substantial impacts in local areas.

Threats to naturally-reproducing SONC coho salmon throughout its range are numerous and varied. Habitat factors include: (1) Channel morphology changes; (2) substrate changes; (3) loss of instream roughness; (4) loss of estuarine habitat; (5) loss of wetlands, (6) loss/degradation of riparian areas; declines in water quality (*e.g.*, elevated water temperatures, reduced dissolved oxygen, altered biological communities, toxics, elevated pH, and altered stream fertility); (7) altered stream flows; (8) fish passage impediments; (9) elimination of habitat; and (10) direct take. The major activities responsible for the decline of coho salmon in Oregon are logging, road building, grazing and mining activities, urbanization, stream channelization, dams, wetland loss, beaver trapping, water withdrawals, and unscreened diversions for irrigation.

Habitat-related factors for decline of OC coho salmon include: (1) Channel morphology changes; (2) substrate changes; (3) loss of in-stream roughness; (4) loss of estuarine habitat; (5) loss of wetlands; (6) loss/degradation of riparian areas; (7) declines in water quality (*e.g.*, elevated water temperatures, reduced dissolved oxygen, altered biological communities, toxics, elevated pH, and altered stream fertility); (8) altered stream flows; (9) fish passage impediments; (10) elimination of habitat; and (11) direct take. The major activities responsible for the decline of coho salmon in Oregon are logging, road building, grazing and mining activities, urbanization, stream channelization, dams, wetland loss, beaver trapping, water withdrawals, and unscreened diversions for irrigation.

2.1.3 Analysis of Effects

2.1.3.1 Effects of Proposed Actions

The effects of the proposed actions are outlined by activity category. However, many of the effects may be valid for more than one category. For example, turbidity impacts resulting from in-water work may occur in the activities of drilling, sampling and drill pad reclamation. The effects may only be listed in one activity section, but are valid for all activities that effect the proposed drilling, surveying, and stormwater and hydraulic engineering program.

2.1.3.1.1 Access Road Construction

Access road construction can affect habitat quality through disturbance of riparian vegetation, increased sedimentation, and chemical contamination.

<u>Riparian Vegetation</u>
Drilling, surveying, and stormwater and hydraulic engineering activity may require removal of vegetation above the ground surface. In most cases, the vegetation will be trimmed and will grow back.

The manipulation of vegetation and large woody material (LWM) associated with provision of site access, excavation, stockpiling, and construction of drilling pads in riparian areas and in stream channels can result in the destruction or removal of vegetation and LWM, as well as trampling of vegetation, shallow or temporary burial of vegetation by stockpiled material, temporary displacement of LWM, and trimming, mowing, and scraping of vegetation.

Vegetation in riparian areas provides soil and streambank stability, runoff infiltration, shade, LWM, and food for fish and their prey. In addition, riparian vegetation and LWM can provide low velocity shelter habitat for fish during periods of flooding, while instream LWM provides similar habitat at all flow levels, as well as shelter from predators, habitat for prey species, sediment storage, and channel stability (Spence *et al*. 1996).

NOAA Fisheries expects that effects on riparian vegetation and LWM recruitment will be minor, localized and temporary. The compensatory mitigation proposed will revegetate all riparian areas disturbed by construction activities at a 2:1 planting ratio, and will maintain or improve habitat conditions at project sites by potentially increasing plant densities in degraded areas or changing plant species at the site to those that are more beneficial to aquatic species.

Mechanized equipment can cause soil compaction, thus reducing soil permeability and infiltration, however, drilling equipment is relatively light and can walk over most vegetation with minimal impact due to low ground pressure.

Sedimentation and Turbidity

Constructing access roads associated with drilling or surveying may increase sediment yield. Earth-disturbing activities, including excavation, stockpiling, vegetation manipulation and construction, can increase delivery of sediment to streams, and increase turbidity in the water column. The severity of the impact depends on numerous factors including the proximity of the action to the water, amount of ground-disturbing activity, slope, amount of vegetation removed, and precipitation. Sediment introduced into streams can degrade spawning and incubation habitat, and reduce primary and secondary productivity (Spence *et al.* 1996). Turbidity from increased fine sediment may disrupt salmonid feeding and territorial behavior. High fine sediment loads also can reduce rearing habitat as pools and interstitial rearing spaces are filled by sediment (Bjornn and Reiser 1991).

Suspended sediment and turbidity influences on fish reported in the literature range from beneficial to detrimental. Elevated total suspended solids (TSS) conditions have been reported to enhance cover conditions, reduce piscivorus fish/bird predation rates, and improve survival. Elevated TSS conditions have also been reported to cause physiological stress, reduce growth, and reduce survival. Of key importance in considering the detrimental effects of TSS on fish are the frequency and duration of exposure.

Behavioral avoidance of turbid waters may be one of the most important effects of suspended sediments (DeVore *et al.* 1980, Birtwell *et al.* 1984, Scannell 1988). Salmonids have been observed to move laterally and downstream to avoid turbid plumes (McLeay *et al.* 1984, 1987, Sigler *et al.* 1984, Lloyd 1987, Scannell 1988, Servizi and Martens 1991). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, except when the fish need to traverse these streams along migration routes (Lloyd *et al.* 1987). In addition, a potentially positive reported effect is providing refuge and cover from predation (Gregory and Levings 1988).

Fish that remain in turbid, or elevated TSS, waters experience a reduction in predation from piscivorus fish and birds (Gregory and Levings 1998). In systems with intense predation pressure, this provides a beneficial trade-off (*e.g.*, enhanced survival) to the cost of potential physical effects (*e.g.*, reduced growth). Turbidity levels of about 23 Nephalometric Turbidity Units (NTU) have been found to minimize bird and fish predation risks (Gregory 1993). Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd 1987, Redding *et al.* 1987, Servizi and Martens 1991).

Newly-emerged salmonid fry may be vulnerable to even moderate amounts of turbidity (Bjornn and Reiser 1991). Other behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985).

Excavation, stockpiling, vegetation manipulation, and construction within the bed of a waterbody or in its adjacent riparian area may introduce sediment into the waterbody or expose sediment which is already present, but below the surface of the bed. For example, while accessing a drill site there may be some disturbance within the riparian zone, as well as the removal of vegetation on the stream bank and riparian zone, which may facilitate the transport of sediment into the stream channel by precipitation run-off and/or by high stream flows. The manipulation of LWM in riparian areas may also affect sediment input to streams, while disturbance or removal of LWM in stream channels may mobilize previously stable accumulations of sediment, or may increase bank erosion.

Auger drilling produces 1.5 to 11.5 cubic meters (m^3) of spoils that could be washed into nearby streams or wetlands, if they are not stabilized or removed from the site. Effects of these disturbances are described in section 2.1.3.1.1 In addition, drilling is usually related to other activities, such as bridge construction within flood plains, that may affect ESA-listed fish or any designated critical habitats. Bare soil is seeded and mulched after construction to establish vegetative growth and reduce surface erosion.

Potential impacts from water- or rotary mud-drilling technique include erosion from water running off the drill site, sedimentation from drilling mud, and vegetation and soil disturbance from erosion control placement, ditching, and site access. In addition, this method has the potential for contamination of nearby streams and/or wetlands from non-contained or filtered drilling fluids. Occasionally, drilling fluid may travel along a subsurface soil layer and exit in a stream or wetland. When this occurs, sediments are deposited in the stream. Occasional operating fluid leaks or spills from the drilling and other equipment also pose a contamination hazard to nearby streams or wetlands.

Excavating test pits eliminates vegetation in the excavated area and can cause vegetation compaction along wheel tracks and in excavated spoils placement areas. Typically, spoils do not erode into streams or wetlands since this material is placed back into the test pit once the investigation or sampling has been completed (usually within a 2 hour time period), and the disturbed area is stabilized by seeding and mulching. In cases where test pits are left open for longer time periods, sediments washed from the spoils piles could enter nearby streams or wetlands, especially during the winter rainy season. Effects from soils testing are similar to those described above for drilling operations.

The BMPs that would be employed on actions in this programmatic Opinion should substantially reduce or entirely eliminate adverse effects to ESA-listed salmonids and their critical habitats.

For example, drilling in the dry, or the recycling of drilling fluids in water-drilling operations should eliminate the potential for direct adverse effect on individual fish. This requirement would also substantially reduce the potential for short-term adverse effects on water quality. Restoration of the contours, topsoil presence, and vegetation should minimize the likelihood of long-term damage to instream and riparian habitat, as would the erosion control conditions.

The effect of sediment on ESA-listed fish from the proposed action will be minimal due to construction and drilling occurring during the time of year when fish are least likely to be present. Sediment created by the drilling process will be isolated from the water and will not have a significant effect on any fish that are present.

Chemical Contamination

Construction of access roads near water bodies increases the risk that toxic or harmful substances will fall or drain into streams and rivers. Wet concrete may accidentally fall into the water and untreated water used to cure concrete may drain into streams, altering the pH of the water and potentially creating an acutely toxic condition for fish. Equipment operation may introduce hazardous materials, including fuel, lubricants, hydraulic fluids, and coolants into streams. These can be acutely toxic to fish at high levels of exposure, and can cause acute and chronic effects to salmonids, aquatic invertebrates, and aquatic and riparian vegetation.

Direct harm to listed fish from chemical contamination while making stream or channel crossings is unlikely because these activities will occur when the stream is dry or when listed fish are generally present at low densities in the stream reaches adjacent to covered activities.

In-water work may be required to access drilling areas. The operation of equipment in the stream has the potential to directly kill or injure listed fish, and is likely to disrupt normal behavior. Operation of equipment in the channel or in riparian areas increases the risk that fuel, lubricants, hydraulic fluids or coolants may enter streams killing or injuring aquatic organisms including ESA-listed salmonids. BMPs that include diapering the equipment and eliminating direct contact with the flowing channel should minimize the potential for harassment of listed fish.

Use of heavy equipment, drilling rigs, supply and equipment vehicles, cranes and other equipment during construction creates the opportunity for accidental spills of fuel, lubricants, hydraulic fluid and similar contaminants into the riparian zone or water where they can injure or kill aquatic organisms. Discharge of construction water used for vehicle washing, concrete washout, pumping for work area isolation, and other purposes can carry sediments as well as a variety of contaminants to the riparian area and stream. Additional direct effects can include spills of these materials into the floodplain with delayed transmittal to the stream, eventually resulting in injury or mortality of aquatic organisms. The production of spoils, contaminated lubricants, and other drilling waste produced by boring also can kill or injure fish if the materials are introduced into the water.

The use of roads constructed for drilling also can result in leakages of fuel, lubricants, *etc.* that can be transmitted to waterbodies if a hydrologic connection (*e.g.* ditch) or a ford exists. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons (PAHs) which can cause acute toxicity to salmonids at high levels of exposure and can also cause chronic lethal as well as acute and chronic sublethal effects to aquatic organisms (Neff 1985). Herbicides used to clear vegetation from and maintain utility ROWs may be deliberately used in riparian areas, where they may enter water bodies. Exposure to herbicides can have lethal and sublethal effects on salmonids, aquatic invertebrates, aquatic vegetation, as well as target and non-target riparian vegetation (Spence *et al.* 1996).

During environmental (hazardous material) drilling all water is contained during the decontamination process to minimize any impacts. The water discharged on site may create erosion if not discharged properly. Alconox water is environmentally inert (See MSDS list). Additional vegetation removal may be necessary to provide a storage area for water barrels. Other effects on vegetation, water, and ground surface are similar to those listed above for other drilling activities. Since this type of testing involves potentially contaminated soils, there is potential for contamination to be spread to nearby water sources.

Air rotary drilling produces dust, flying sand-sized rock particles, foaming additives, and fine water spray that could be deposited in streams or wetlands if a collection device is not used. The distance that cuttings and liquids (*e.g.* water, foaming additives) can be ejected out of the boring depend on the size of the drilling equipment. Unrestrained, larger equipment will disperse particles up to 6.1 m, while smaller equipment will typically expel particles 3 m. Operating fluid leaks or spills from the drilling rig and other on-site equipment could pose a contamination hazard to nearby streams or wetlands.

During boring abandonment, when the boring is situated near streams or wetlands, excess grout may not be contained in the area of the boring (especially during rainy periods) and may potentially contaminate these areas. Boring abandonment may not occur for months or even years after the drilling has been completed. If this is the situation, then vegetation may be affected when workers re-enter the site. These effects will be similar to those described above for site access. In addition, under certain circumstances, the instruments may need to be drilled out. When this occurs, effects are similar to those described above for the particular drilling operation.

The likelihood of effects from chemical contamination in drilling projects is very low due to the drilling usually taking place in the dry. Drilling pads would be set up to contain any spills that may occur. The BMPs that have been proposed are likely to minimize the opportunity for contaminants to come into contact with the water and affect ESA-listed fish.

2.1.3.1.2 Drill Pad Preparation

Drill pad preparation can cause habitat effects including disturbances of riparian vegetation and floodplains, sedimentation, and chemical contamination, as well as direct effects on listed species, such as harm and harrassment.

The effects associated with riparian vegetation disturbance, sedimentation, and chemical contamination are covered in section 2.1.3.1.1 above. Additional effects are listed below.

<u>Soil and Floodplain Hydrologic Functions</u>
Most of the actions under this program will be small and discrete, and dispersed among multiple watersheds and ESUs. Hard armoring or riprap is not necessary during drilling or surveying activities. Low ground pressure vehicles would be used, thereby minimizing any soil compaction. FHWA has proposed BMPs in the BA to avoid and minimize loss of vegetation. Site remediation will be implemented for some projects, on a case-by case basis, potentially reducing any cumulative impacts. Overall, NOAA Fisheries does not expect significant effects on soil and floodplain hydrologic functions that would degrade the habitat of listed salmon or steelhead.

<u>Harm and Harrassment</u>
In-water work associated with reclamation activities could disturb, kill or injure ESA-listed salmonids through turbidity, noise, contact (or near-contact) with equipment, compaction and disturbance of instream gravel from heavy equipment, and modification of adjacent riparian areas. Juvenile fish that may be rearing in the action areas would most likely be displaced rather than killed or injured. In some cases, fish densities are likely to be low during the required in-water work period because this timing generally avoids the spawning period, and most smolt out-migration has already occurred. Statewide, this can vary.

The greatest direct effects of the proposed actions on individual listed salmon and steelhead will likely be caused by the isolation of in-water areas. Although work area isolation is itself a conservation measure intended to reduce the adverse effects of erosion and runoff on the population, any individual fish present in the work isolation area will be captured and released. Capturing and handling fish causes stress, although fish typically recover fairly rapidly from the process, and therefore the overall effects of the procedure are generally short-lived (NOAA Fisheries 2002a). The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen concentrations, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18° C or if dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis.

2.1.3.1.3 Drilling and Sampling, Mobilization, Setup, De-mobilization and Boring Abandonment Operations

Actions related to geotechnical drilling, including excavation, fill placement, stockpiling of excavated material, vegetation removal and modification, construction of access roads, and the actual drilling may introduce sediment, turbidity, and contaminants into water bodies, and may disturb or destroy riparian vegetation.

These effects are discussed in sections 2.1.3.1.1 and 2.1.3.1.2, above.

2.1.3.1.4 Project Development, Construction, Boundary Surveys, and Stormwater and Hydraulic Engineering Surveys

The various surveys included in this Opinion will have minor affects on habitat elements. Some of these surveys will require minor vegetation removal and some minor ground disturbance (installing survey stakes, utility locates, *etc.*) that could lead to sedimentation. These effects are described in sections 2.1.3.1.1 and 2.1.3.1.2, above. Hydraulic engineering studies may include some instream measurements. If these surveys are done during spawning times, salmonid redds could be disturbed if they are walked upon. This could kill eggs in the gravel and reduce emergence of fry out of the gravel. If these surveys involve in-water measurements, they will be done outside of the spawning and incubation season or with the accompaniment of a biologist that can recognize redds. This will reduce the potential for disturbance of redds.

2.1.3.1.5 Summary of Effects

The proposed actions are expected to adversely affect several environmental conditions and functions in each of the main watersheds in which the activities occur, but NOAA Fisheries expects the effects to be localized and temporary. The majority of the drilling, surveying, and stormwater and hydraulic engineering actions affect small portions of stream habitat. Usually the effects would occur in areas that have been already disturbed, such as the location of an existing bridge, a location adjacent to a disturbed area, or an area where a new bridge will be constructed.
Drilling procedures and accessing drill sites can degrade riparian areas, usually in the form of vegetation disturbance. Timing and construction restrictions would minimize these impacts. Plantings and restoration of adjacent riparian areas would alleviate any long-term impacts to the existing riparian areas, and would potentially improve the existing condition.

Construction of drilling pads, access roads, and site restoration can have effects such as sedimentation and chemical contamination. Other activities associated with drilling and surveying activities may have effects including disturbance of riparian vegetation, possible reductions in LWM recruitment, increased turbidity and sedimentation, and increased risk of chemical contamination. Also, ESA-listed species may be harmed or harrassed by in-water activities. These effects will be localized, dispersed among various watersheds, and minimized by BMPs and NOAA Fisheries does not expect degradation of aquatic habitats over the long term. Site restoration will further reduce effects of these activities over the long term.

2.1.3.2 Effects on Critical Habitat

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. Essential features for designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage.

Effects to critical habitat from these activities are included in the effects analysis, above.

2.1.3.3 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Other activities within the watershed have the potential to impact fish and habitat within the action area. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes.

Non-federal activities within the action area are expected to increase with a projected 34% increase in human population over the next 25 years in Oregon (Oregon Department of Administrative Services 1999). Thus, NOAA Fisheries assumes that future private and state actions will continue within the action area, but at increasingly higher levels as population density climbs.

2.1.4 Conclusion

NOAA Fisheries has determined, based on the information, analysis, and assumptions described in this Opinion, that the FHWA's proposed permit conditions for geotechnical drilling and surveying activities are not likely to jeopardize the continued existence of the ESA-listed salmon and steelhead species shown in Table 1. In arriving at this determination, NOAA Fisheries considered the status of listed salmon and steelhead species, the environmental baseline conditions, the direct and indirect effects of approving the action, and the cumulative effects of actions anticipated in the action area. NOAA Fisheries evaluated the proposed actions and found that they would cause short-term, localized, and generally minor degradation of some habitat features for listed salmon and steelhead. However, NOAA Fisheries does not expect the proposed actions to result in further degradation of aquatic habitats over the long term. This determination is based in part on incorporation of BMPs into the proposed actions that reduce project effects. Also, riparian effects from drilling operations will be minor, localized and infrequent, with subsequent restoration of vegetation. Thus, the proposed actions would not reduce prespawning survival, egg-to-smolt survival, or survival during upstream or downstream migration to a level that would appreciably diminish the likelihood of survival and recovery of proposed or listed fishes, nor is it likely to result in destruction or adverse modification of critical habitats.

2.1.5 Conservation Recommendations

Section 7 (a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitats, or to develop additional information. NOAA Fisheries believes the conservation measures and the BMPs in the BA for this action are consistent with these obligations, and recommends no additional conservation measure be carried out by the FHWA.

2.1.6 Reinitiation of Consultation

Consultation must be reinitiated after 3 years. Consultation also must be reinitiated if: (1) The amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the actions are modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). To reinitiate consultation, FHWA should contact the Oregon Habitat Branch of NOAA Fisheries.

2.2 Incidental Take Statement

Section 9 and rules promulgated under section 4(d) of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, and sheltering. "Harass" is defined as actions that create the likelihood of injuring listed species by annoying it to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. "Incidental take" is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts, and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.2.1 Amount or Extent of the Take

NOAA Fisheries anticipates that the action covered by this Opinion is reasonably certain to result in incidental take of the species listed in Table 1 due to in-water activities resulting in turbidity and direct take during fish removal. ESA-listed species destined for the upper Columbia River or the Snake River (UCR steelhead, SR steelhead, SR sockeye, SR fall-run chinook, SR spring/summer-run chinook, and UCR spring chinook), have a relatively low probability of being affected by geotechnical drilling and surveying activities because these activities will be isolated from the aquatic environment, drilling fluids will be contained and taken off-site, and most drilling work will be done outside of the wetted channel. Effects of actions such as these are largely unquantifiable and are likely to be limited to non-lethal behavioral modification, and possibly minor reductions in juvenile growth due to temporary reductions in food availability and habitat-carrying capacity. These effects are unlikely to be measurable as long-term effects on population levels. Therefore, even though NOAA Fisheries expects some small amount of incidental take to occur due to the actions covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take to the species itself. In instances such as these, NOAA Fisheries designates the expected level of take as "unquantifiable." In instances such as this, NOAA Fisheries designates the expected level of take in terms of the extent of take allowed. Therefore, NOAA Fisheries limits the extent of allowable incidental take to take resulting from the action as proposed that occurs in the aquatic area adjacent to the drilling or sampling operation, extending downstream 30 meters below the project area. Incidental take from any action not described in this Opinion or that occurs beyond these areas is not authorized by this consultation.

NOAA Fisheries also anticipates incidental take of ESA-listed fish during work area isolation and fish removal, and limits this to non-lethal take of 475 juvenile fish, and lethal take of twenty-five juvenile fish during the 3-year life of this Programatic Opinion.

2.2.2 Reasonable and Prudent Measures

The measures described below are non-discretionary. They must be implemented so that they become binding conditions in order for the exemption in section 7(a)(2) to apply. FHWA has the continuing duty to regulate the activities covered in this incidental take statement. If FHWA fails to require the applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. Activities carried out in a manner consistent with these reasonable and prudent measures, except those otherwise identified, will not necessitate further site-specific consultation. Activities that do not comply with all relevant reasonable and prudent measures will require further individual consultation.

The following reasonable and prudent measures are necessary and appropriate to minimize the likelihood of take of listed fish resulting from implementation of this Opinion. These reasonable and prudent measures would also minimize adverse effects to designated critical habitats.

1. Minimize the likelihood of incidental take from construction and surveying activities (access road construction, drill pad preparation, reclamation, drilling and sampling operations, mobilization, de-mobilization and boring abandonment) by applying BMPs to avoid or minimize disturbance to listed species and riparian and aquatic systems.

2. Minimize the likelihood of incidental take by isolating in-water work and applying BMPs to avoid or minimize disturbance to listed species, riparian areas and aquatic habitats.

3. Ensure effectiveness of implementation of the reasonable and prudent measures by requiring that all erosion control measures and plantings for site restoration, are monitored and evaluated both during and following construction.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, FHWA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above for each category of activity. These terms and conditions are non-discretionary. Many of the terms and conditions are relevant to more than one category of activity (*e.g.* conditions to minimize turbidity increases are equally important in access road construction, drilling operations). Therefore, terms and conditions listed under one category of activity are also terms and conditions of any category in which they would also minimize listed Pacific salmon or their habitats.

1. To implement reasonable and prudent measure #1 (access road construction, drill pad preparation, reclamation, drilling and sampling operations, mobilization, de-mobilization and boring abandonment), the FHWA shall ensure that:

   a. <u>Timing of in-water work</u>. Work within the active channel will be completed during the ODFW (2000) preferred in-water work period[3], as appropriate for the project area, unless otherwise approved, in writing, by NOAA Fisheries.
   b. <u>Hydraulic engineering</u>. Hydraulic measurements that require access to the wetted channel will be done outside of the spawning season or will have a biologist verify that there are no redds present at the site.
   c. <u>Cessation of work</u>. Project operations will cease under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.

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[3] Oregon Department of Fish and Wildlife, *Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources*, 12 pp (June 2000) (identifying work periods with the least impact on fish) (http://www.dfw.state.or.us/ODFWhtml/InfoCntrHbt/0600_inwtrguide.pdf)

d. Fish screens. Water intakes used for a project, including pumps used to isolate an in-water work area, will have a fish screen installed, operated and maintained according to NOAA Fisheries' fish screen criteria.[4]

e. Fish passage. Passage will be provided for any adult or juvenile salmonid species present in the project area during construction, and after construction for the life of the project. Upstream passage is not required during construction if it did not previously exist.

f. Pollution and erosion control plan. A pollution and erosion control plan will be prepared and carried out to prevent pollution related to drilling operations. The plan must be available for inspection on request by FHWA or NOAA Fisheries.

    I. Plan contents. The pollution and erosion control plan must contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.

    (1) Practices to prevent erosion and sedimentation associated with access roads, stream crossings, construction sites, drilling sites, haul roads, equipment and material storage sites, fueling operations and staging areas.
    (2) Practices to confine, remove and dispose of excess concrete, cement and other mortars or bonding agents, including measures for washout facilities.
    (3) A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
    (4) A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
    (5) Practices to prevent construction debris from dropping into any stream or waterbody, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.
    (6) Inspection of erosion controls. During construction, all erosion controls must be inspected daily during the rainy season and weekly during the dry season to ensure they are working adequately.[5]
    (7) If inspection shows that the erosion controls are ineffective, work crews must be mobilized immediately to make repairs, install replacements, or install additional controls as necessary.

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[4] National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm).

[5] "Working adequately" means no turbidity plumes are evident during any part of the year.

(8) Sediment must be removed from erosion controls once it has reached 1/3 of the exposed height of the control.

g. Construction discharge water. All discharge water created by construction (*e.g.*, pumping for work area isolation, vehicle wash water, drilling fluids) will be treated as follows.

I Water quality. Facilities must be designed, built and maintained to collect and treat all construction discharge water using the best available technology applicable to site conditions. The treatment must remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present.

ii. Discharge velocity. If construction discharge water is released using an outfall or diffuser port, velocities must not exceed 4 feet per second.

iii. Spawning areas, submerged estuarine vegetation. No construction discharge water may be released within 300 feet (upstream) of active spawning areas or areas with submerged estuarine vegetation.

iv. Pollutants. Pollutants including green concrete, contaminated water, silt, welding slag, or sandblasting abrasive will not contact any wetland or the 2-year floodplain. An exception to this would be the use of cement or grout when abandoning a drill boring or installation of instrumentation in the boring.

h. Preconstruction activity. Before significant[6] alteration of the project area, the following actions must be completed:

I. Marking. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of critical riparian vegetation, wetlands and other sensitive sites beyond the flagged boundary.

ii. Emergency erosion controls. Ensure that the following materials for emergency erosion control are onsite.

(1) A supply of sediment control materials (*e.g.*, silt fence, straw bales[7]).

(2) An oil-absorbing, floating boom whenever surface water is present.

iii. Temporary erosion controls. All temporary erosion controls must be in place and appropriately installed downslope of project activity within the riparian area until site restoration is complete.

iv. Equipment. Any equipment or vehicles used on the project must be steam cleaned to a level where soluble or dislodgable contaminants are not visible on the equipment or vehicle prior to entering a wetted stream.

I. Temporary access roads.

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[6] "Significant" means an effect can be meaningfully measured, detected or evaluated.

[7] When available, certified weed-free straw or hay bales must be used to prevent introduction of noxious weeds.

I. Existing ways. Existing roadways or travel paths must be used whenever possible, unless construction of a new way would result in less habitat disturbance.

ii. Minimizing soil disturbance and compaction. When a new temporary road is necessary within 150 feet[8] of a stream, waterbody or wetland, soil disturbance and compaction must be minimized by clearing vegetation to ground level and placing clean gravel over geotextile fabric, unless otherwise approved in writing by NOAA Fisheries. An acceptable exception would to walk a low-impact tracked drill to access the site, eliminating the need for the road, geotextile fabric and gravel.

iii. Temporary stream crossings.

(1) The number of temporary stream crossings must be minimized.

(2) Temporary road crossings must be designed as follows.

(a) A survey must identify and map any potential spawning habitat within 300 feet (downstream) of a proposed crossing.

(b) No stream crossing may occur at known or suspected spawning areas, or within 300 feet (upstream) of such areas if spawning areas may be affected.

(c) The crossing design must provide for foreseeable risks (*e.g.*, flooding and associated bedload and debris) to prevent the diversion of streamflow out of the channel and down the road if the crossing fails.

(d) Vehicles and machinery must cross riparian areas and streams at right angles to the main channel wherever possible.

(e) Culverts must meet fish passage guidelines and requirements when fish are present.

iv. Obliteration. When the project is completed, all temporary access roads must be obliterated, the soil must be stabilized, and the site must be revegetated. Temporary roads in wet or flooded areas must be abandoned and restored as necessary by the end of the in-water work period.

j. Heavy Equipment. Use of heavy equipment will be restricted as follows:

i. Choice of equipment. When heavy equipment must be used, the equipment selected must have the least adverse effects on the environment (*e.g.*, minimally-sized, low ground pressure equipment).

ii. Vehicle staging. Vehicles must be fueled, operated, maintained and stored as follows:

(1) Vehicle staging, cleaning, maintenance, refueling, and fuel storage must take place in a vehicle staging area placed 150 feet or more from

[8] Distances from a stream or waterbody are measured horizontally from, and perpendicular to, the bankfull elevation, the edge of the channel migration zone, or the edge of any associated wetland, whichever is greater. "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years, e.g., alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams.

any stream, waterbody or wetland. If these activities are needed at a stationary drilling site (many times within 150 feet of a stream, waterbody or wetland), the pad needs to be fully contained to prevent chemical contamination.

(2) All vehicles operated within 150 feet of any stream, waterbody or wetland must be inspected daily for fluid releases before leaving the vehicle staging area. Releases detected must be repaired in the vehicle staging area before the vehicle resumes operation. Repairs and maintenance on the drilling pad will be completed while the pad is fully contained. Inspections must be documented in a record that is available for review on request by FHWA or NOAA Fisheries.

(3) Equipment operated within the active channel must be cleaned before beginning operations below the bankfull elevation to remove all external oil, grease, dirt, and mud.

iii. Stationary power equipment. Stationary power equipment (*e.g.*, generators, cranes, drilling equipment) operated within 150 feet of any stream, waterbody or wetland must be diapered to prevent leaks, unless it is isolated on a drilling pad or otherwise approved in writing by NOAA Fisheries.

k. Site preparation. Native materials must be conserved for site restoration.

i. If possible, native materials must be left where they are found.

ii. Materials that are moved, damaged or destroyed must be replaced with a functional equivalent during site restoration.

iii. Any large wood[9], native vegetation, weed-free topsoil, and native channel material displaced by construction must be stockpiled for use during site restoration.

l. Earthwork and site restoration. Earthwork (including drilling, excavation, dredging, filling and compacting) will be completed as quickly as possible.

i. Site stabilization. All disturbed areas must be stabilized, including obliteration of temporary roads, within 5 days of any break in work unless construction will resume work within 7 days during the designated in-water work period.

ii. Source of materials. Boulders, rock, woody materials and other natural construction materials used for the project must be obtained outside the riparian area.

[9] For purposes of this Opinion only, "large wood" means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull width of the stream in which the wood occurs. See, Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 (www.odf.state.or.us/FP/RefLibrary/LargeWoodPlacemntGuide5-95.doc).

iii. Streambank shaping. Damaged streambanks must be restored to a natural slope, pattern and profile suitable for establishment of permanent woody vegetation.

iv. Revegetation. Areas requiring revegetation must be replanted before the first April 15 following construction with a diverse assemblage of species that are native to the project area or region, including grasses, forbs, shrubs and trees. Seed applications and vegetation planting must be native stock.

v. Sampling sites. Sampling sites will be immediately filled in after the necessary data is collected. This area will be stabilized replanted prior to completion of the project.

vi. Pesticides. No pesticide application is covered under this take statement, although mechanical or other methods may be used to control weeds and unwanted vegetation.

vii. Fertilizer. Surface application of fertilizer within 50 feet of any stream channel is not covered under this take statement.

m. Permanent stream crossings. Permanent stream crossings will be built as follows:

i. Design.

(1) Crossing types.[10] Design road crossings in the following priority:

(2) Nothing – road realignment to avoid crossing the stream.

(3) Bridge – spanning the stream to allow for long-term dynamic channel stability.

(4) Streambed simulation – bottomless arch, embedded culvert, or ford.

(5) No-slope design culvert[11] – sometimes referred to as hydraulic design, here limited to 0% slopes.

ii. If the crossing will occur near an active spawning area, only full span bridges or streambed simulation must be used.

iii. Fill width must be limited to the minimum necessary to complete the crossing, and must not reduce existing stream width.

n. New culverts.

i. To provide for upstream passage of juvenile salmonids, the maximum average water velocity[12] shall not exceed 1 foot per second.

ii. Suitable grade controls must be included to prevent culvert failure caused by changes in stream elevation.

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[10] For a discussion of crossing design types, see, National Marine Fisheries Service, Southwest Region, *Guidelines for Salmonid Passage at Stream Crossings* (September 2001) (http://swr.nmfs.noaa.gov/hcd/NMFSSCG.PDF) and Washington Department fo Fish and Wildlife, *Fish Passage Design at Road Culverts: A Design Manual for Fish Passage at Road Crossings* (March 3, 1999) (http://www.wa.gov/wdfw/hab/engineer/cm/toc.htm).

[11] "No-slope design culvert" means a culvert that is sufficiently large and is installed flat to allow the natural movement of bedload to form a stable bed inside the culvert.

[12] "Maximum average water velocity" means the average of water velocity within the barrel of the culvert calculated using the 10% annual exceedance of the daily average flow.

2. To implement reasonable and prudent measure #2, the FHWA shall ensure that any in-water work activities (drilling and sampling) are isolated from flowing water.

   a. Isolation of in-water work area. If adult or juvenile fish are reasonably certain to be present, the work area will be well isolated from the active flowing stream using inflatable bags, sandbags, sheet pilings, or similar materials. The work area will also be isolated if in-water work may occur within 300 feet of spawning habitats located downstream of the project.
   b. Capture and release. Before and intermittently during pumping to isolate an in-water work area, an attempt must be made to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury to listed species.
      i. A fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish must conduct or supervise the entire capture and release operation.
      ii. If electrofishing equipment is used to capture fish, the capture team must comply with NOAA Fisheries' electrofishing guidelines as follows:[13]
         (1) Electrofishing may not occur near listed adults in spawning condition or near redds containing eggs.
         (2) Equipment must be in good working condition. Operators must go through the manufacturer's preseason checks, follow all provisions, and record major maintenance work in a log.
         (3) A crew leader having at least 100 hours of electrofishing experience in the field using similar equipment must train the crew. The crew leader's experience must be documented and available for confirmation; such documentation may be a logbook. The training must occur before an inexperienced crew begins any electrofishing; it must also be conducted in waters that do not contain listed fish.
         (4) Measure conductivity and set voltage as follows:

Conductivity (umhos/cm)	Voltage
Less than 100	900 to 1100
100 to 300	500 to 800
Greater than 300	150 to 400

         (5) Direct current (DC) must be used at all times.
         (6) Each session must begin with pulse width and rate set to the minimum needed to capture fish. These settings will be gradually increased only to the point where fish are immobilized and captured. Start with pulse width of 500 us and do not exceed 5 milliseconds. Pulse rate will start

[13] National Marine Fisheries Service, *Backpack Electrofishing Guidelines* (December 2000) (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf).

at 30Hz and work carefully upwards. In general, pulse rate will not exceed 40 Hz, to avoid unnecessary injury to the fish.

(7) The zone of potential fish injury is 0.5 m from the anode. Care will be taken in shallow waters, undercut banks, or where fish can be concentrated because in such areas the fish are more likely to come into close contact with the anode.

(8) The monitoring area must be worked systematically, moving the anode continuously in a herringbone pattern through the water. Do not electrofish one area for an extended period.

(9) Crew members must carefully observe the condition of the sampled fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit may need adjusting. Sampling must be terminated if injuries occur or abnormally long recovery times persist.

(10) Whenever possible, a block net must be placed below the area being sampled to capture stunned fish that may drift downstream.

(11) The electro-fishing settings must be recorded in a logbook along with conductivity, temperature, and other variables affecting efficiency. These notes, with observations on fish condition, will improve technique and form the basis for training new operators.

(12) The capture team must handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.

(13) Captured fish must be released as near as possible to capture sites.

(14) ESA-listed fish may not be transferred to anyone except NOAA Fisheries personnel, unless otherwise approved in writing by NOAA Fisheries.

(15) Other Federal, state, and local permits necessary to conduct the capture and release activity must be obtained.

(16) NOAA Fisheries or its designated representative must be allowed to accompany the capture team during the capture and release activity, and must be allowed to inspect the team's capture and release records and facilities.

c. Drilling and Sampling. During drilling or sampling operations the following will apply.

i. Sampling and directional drill recovery/recycling pits, and any associated waste or spoils must be completely isolated from surface waters. All drilling fluids and waste must be recovered and recycled or disposed to prevent entry into flowing water.

ii. Drilling operations in wetted stream channels will be isolated via a steel pile, sleeve or other appropriate isolation method to prevent drilling fluids from impacting the stream.

iv. If it is necessary to drill through the bridge deck, containment measures will be in place to keep debris from entering the channel.

v. Recycling of drilling fluids via a tank is preferred over the use of drill recovery/recycling pits.

vi. If a drill boring conductor breaks and drilling fluid or waste is visible in the waters (including wetlands), all drilling activity must cease pending concurrence with a regional biologist that the impacts are negligible and drilling can resume.

vii. Adequate surveying will be done to ensure that drill recovery/recycling pits are isolated from any wetlands or off-channel habitat.

viii. Drill pads will be self-contained such that in case of a spill there is no danger of contaminants entering any waterbody.

3. To implement reasonable and prudent measure #3 (monitoring and reporting), the FHWA shall ensure that:

a. Implementation monitoring. Ensure that each permittee submits a monitoring report to the FHWA within 120 days of project completion describing the success meeting the terms and conditions in this Opinion. Each project level monitoring report will include the following information.

i. Project identification

(1) Permittee name, consultation number, and project name.

(2) Type of activity.

(3) Project location, including any compensatory mitigation site(s), by 5th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map

(4) FHWA contact person.

(5) Starting and ending dates for work completed.

ii. Narrative assessment. A narrative assessment of the project's effects on natural stream and riparian functions.

iii. Photo documentation. Photo of habitat conditions at the project and any compensation site(s), before, during, and after project completion.[14]

(1) Include general views and close-ups showing details of the project and project area, including pre and post construction.

(2) Label each photo with date, time, project name, photographer's name, and a comment about the subject.

iv. Other data. Additional project-specific data, as appropriate for individual projects.

(1) Work cessation. Dates work ceased due to high flows.

(2) Fish screen. Compliance with NOAA Fisheries' fish screen criteria.

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[14] Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable environmental conditions at the project area, and upstream and downstream of the project.

(3) Pollution and erosion control. A summary of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort.

(4) Site preparation.

(5) Total cleared area – riparian and upland.

(6) Total new impervious area.

v. Isolation of in-water work area, capture and release.

(1) Supervisory fish biologist – name and address.

(2) Methods of work area isolation and take minimization.

(3) Stream conditions before, during and within one week after completion of work area isolation.

(4) Means of fish capture.

(5) Number of fish captured by species.

(6) Location and condition of all fish released.

(7) Any incidence of observed injury or mortality of listed species.

vi. Site restoration.

(1) Finished grade slopes and elevations.

(2) Log and rock structure elevations, orientation, and anchoring (if any).

(3) Planting composition and density.

(4) A 5-year plan to:

(a) Inspect and, if necessary, replace failed plantings to achieve 100% survival at the end of the first year, and 80% survival or 80% coverage after 5 years (including both plantings and natural recruitment).

(b) Control invasive non-native vegetation.

(c) Protect plantings from wildlife damage and other harm.

(d) Provide the FHWA annual progress reports.

vii. Long-term habitat loss. This will consist of the same elements as monitoring for site restoration.

b. Annual monitoring report. Provide NOAA Fisheries with an annual monitoring report by January 31 of each year that describes the FHWA's efforts carrying out the proposed action and the terms and conditions in this Opinion. The report will summarize project level monitoring information by activity and by 5th field HUC, with special attention to site restoration, streambank protection and compensatory mitigation. The report will also provide an overall assessment of program activity and cumulative effects. A copy of the annual report will be submitted to the Oregon Offices of NOAA Fisheries.

Branch Chief - Portland
National Marine Fisheries Service
Attn: OSB2001-0016
525 NE Oregon Street
Portland, OR 97232

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).
- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A)).
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 C.F.R. 600.10). "Adverse effect" means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed actions would adversely affect designated EFH, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of EFH

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for Federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the FHWA.

3.3 Proposed Actions

The proposed action and action area is detailed above in section 1.2 of this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of groundfish, coastal pelagic species, and Pacific salmon (Table 2).

3.4 Effects of Proposed Actions

As described in detail in section 2.1.3.1 of this Opinion, the proposed actions may result in short-term adverse effects to a variety of habitat parameters. These adverse effects are:

1. Reductions in riparian functions including shade, bank stability, and recruitment of LWM into streams.
2. Increases in suspended sediment and turbidity.
3. Introduction of pollutants into water bodies.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action will adversely affect the EFH for the groundfish, coastal pelagic, and Pacific salmon species listed in Table 2.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. The terms and conditions outlined in section 2.2.3 are generally applicable to designated EFH for the species in Table 2, and address these adverse effects. Consequently, NOAA Fisheries recommends that they be implemented as EFH conservation measures.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The FHWA must reinitiate EFH consultation with NOAA Fisheries if the proposed actions are substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

Table 2. Species with designated EFH affected by this consultation.[15]

GROUND FISH SPECIES	Blue rockfish (*S. mystinus*)	Rougheye rockfish (*S. aleutianus*)	Flathead sole (*Hippoglossoides elassodon*)
Leopard shark (*Triakis semifasciata*)	Bocaccio (*S. paucispinis*)	Sharpchin rockfish (*S. zacentrus*)	Pacific sanddab (*Citharichthys sordidus*)
Soupfin shark (*Galeorhinus zyopterus*)	Brown rockfish (*S. auriculat-+us*)	Shortbelly rockfish (*S. jordani*)	Petrale sole (*Eopsetta jordani*)
Spiny dogfish (*Squalus acanthias*)	Canary rockfish (*S. pinniger*)	Shortraker rockfish (*S. borealis*)	Rex sole (*Glyptocephalus zachirus*)
Big skate (*Raja binoculata*)	Chilipepper (*S. goodei*)	Silvergray rockfish (*S. brevispinus*)	Rock sole (*Lepidopsetta bilineata*)
California skate (*R. inornata*)	China rockfish (*S. nebulosus*)	Speckled rockfish (*S. ovalis*)	Sand sole (*Psettichthys melanostictus*)
Longnose skate (*R. rhina*)	Copper rockfish (*S. caurinus*)	Splitnose rockfish (*S. diploproa*)	Starry flounder (*Platyichthys stellatus*)
Ratfish (*Hydrolagus colliei*)	Darkblotched rockfish (*S. crameri*)	Stripetail rockfish (*S. saxicola*)	
Pacific rattail (*Coryphaenoides acrolepsis*)	Grass rockfish (*S. rastrelliger*)	Tiger rockfish (*S. nigrocinctus*)	**COASTAL PELAGIC SPECIES**
Lingcod (*Ophiodon elongatus*)	Greenspotted rockfish (*S. chlorostictus*)	Vermillion rockfish (*S. miniatus*)	Northern anchovy (*Engraulis mordax*)
Cabezon (*Scorpaenichthys marmoratus*)	Greenstriped rockfish (*S. elongatus*)	Widow Rockfish (*S. entomelas*)	Pacific sardine (*Sardinops sagax*)
Kelp greenling (*Hexagrammos decagrammus*)	Longspine thornyhead (*Sebastolobus altivelis*)	Yelloweye rockfish (*S. ruberrimus*)	Pacific mackerel (*Scomber japonicus*)
Pacific cod (*Gadus macrocephalus*)	Shortspine thornyhead (*Sebastolobus alascanus*)	Yellowmouth rockfish (*S. reedi*)	Jack mackerel (*Trachurus symmetricus*)
Pacific whiting (Hake) (*Merluccius productus*)	Pacific Ocean perch (*S. alutus*)	Yellowtail rockfish (*S. flavidus*)	Market squid (*Loligo opalescens*)
Sablefish (*Anoplopoma fimbria*)	Quillback rockfish (*S. maliger*)	Arrowtooth flounder (*Atheresthes stomias*)	
Aurora rockfish (*Sebastes aurora*)	Redbanded rockfish (*S. babcocki*)	Butter sole (*Isopsetta isolepsis*)	**SALMON**
Bank Rockfish (*S. rufus*)	Redstripe rockfish (*S. proriger*)	Curlfin sole (*Pleuronichthys decurrens*)	Coho salmon (*O. kisutch*)
Black rockfish (*S. melanops*)	Rosethorn rockfish (*S . helvomaculatus*)	Dover sole (*Microstomus pacificus*)	Chinook salmon (*O. tshawytscha*)
Blackgill rockfish (*S. melanostomus*)	Rosy rockfish (*S. rosaceus*)	English sole (*Parophrys vetulus*)	

[15] From Casillas *et al* 1998, Eschmeyer *et al.* 1983, Miller and Lea 1972, Monaco *et al.* 1990, Emmett *et al.* 1991, Turner and Sexsmith 1967, Roedel 1953, Phillips 1957, Roedel 1948, Phillips 1964, Fields 1965, Walford 1931, Gotshall 1977, Hart 1973, Healey 1991, Sandercock 1991, Bottom *et al.* 1984, Schultz 1953, and Dees 1961.

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